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'86 STATISTICAL PANORAMA

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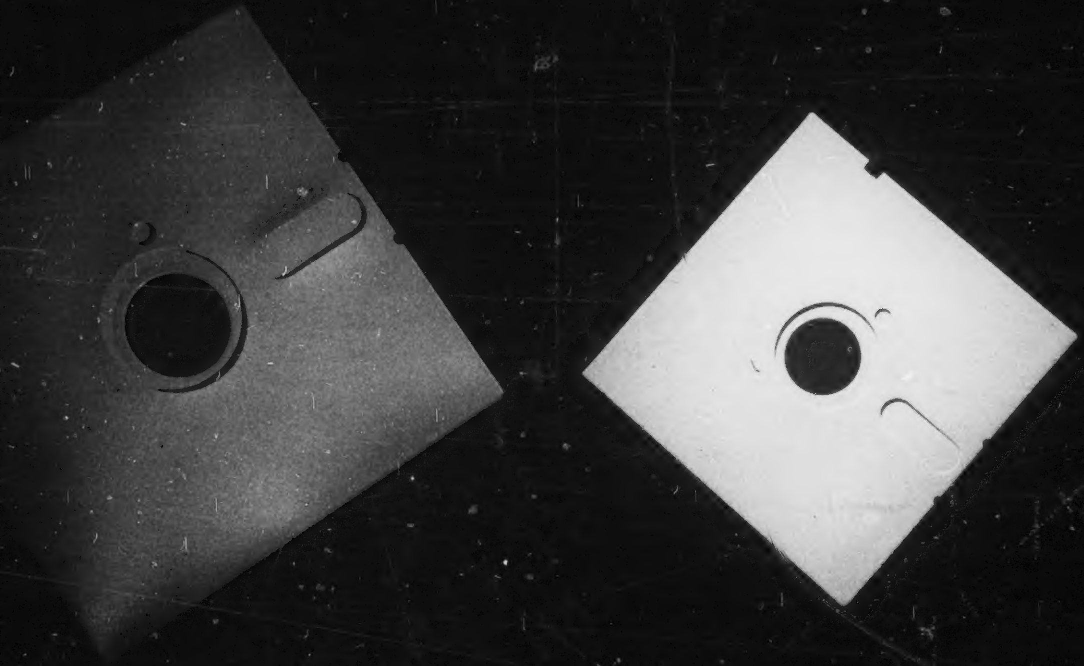

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How lower fuel prices will impact contractors

THE NEWS
AIR CONDITIONING HEATING AND REFRIGERATION
THE INDUSTRY WEEKLY

The World of Tecumseh

Where Imagination and Innovation Continue to Shape Many Industries

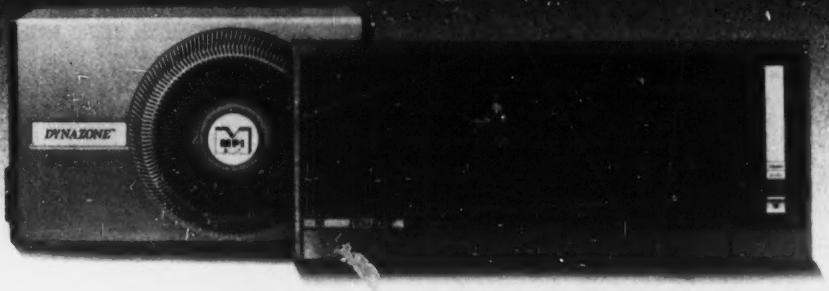
In today's highly competitive and fast-changing global economy, the need for technically advanced components—of the highest quality, yet fairly priced—has never been greater.

At Tecumseh, we are investing millions of dollars in research and development, in engineering, and in state-of-the-art manufacturing techniques in order to provide our customers with refrigeration and air conditioning compressors, gasoline engines, power transmissions, and fluid pumps which offer greater performance and efficiency than ever before. A half century of experience is behind us—a world of promise before us.

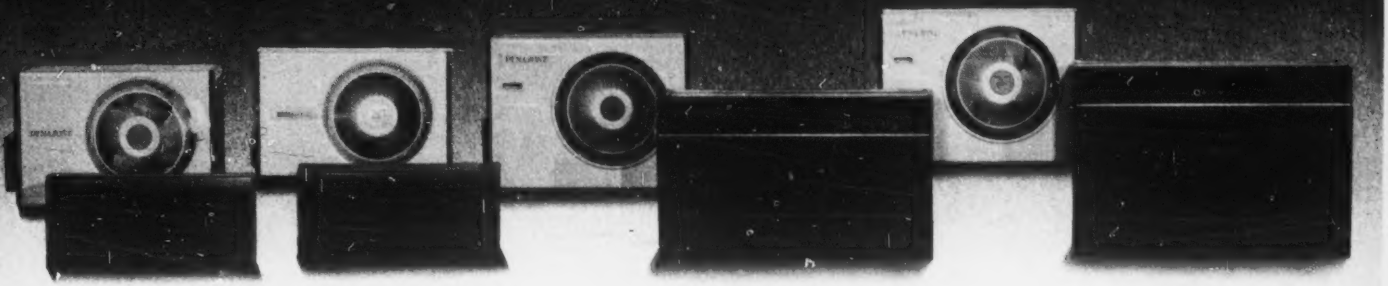
rcle 60

TECUMSEH PRODUCTS COMPANY
Tecumseh, Michigan 49286

Last year, the number 1 split system room air conditioner.



This year, more of the same.



Last year, ARI rated the Dynazone 8,700 BTU Model C850C the quietest, most efficient split system air conditioner in its class. In fact, with a SEER of 11.25 and sound ratings of only 6.0, it just about blew away the competition.

That was good for openers. But now we're going six units better. By offering six new split systems with cooling capacities that range from 12,000 BTUs all the way to 23,000 BTUs. We even offer a triple-zoned system that delivers a remarkable 29,000 BTUs.

Every one of our new systems boasts the same quality design and manufacture that has made the C850C number 1. And each comes with such features as a high-efficiency Hitachi compressor, a wall hung or floor console evaporator blower, all mounting hardware, and a precharged condenser that works in all types of weather. Most important, all are offered by Monitor Products, an American company who knows the American air conditioner market.

For more information about Dynazone split system air conditioners, or to find out how you can become a Dynazone dealer, call us at 1-800-524-1102 (in New Jersey, call 201-725-9610). Or write us at Monitor Products, Inc., P.O. Box 180, Raritan, NJ 08869. We'll give you even more reasons why our line of split system air conditioners adds up to profits for your business.

MPi DYNAZONE™

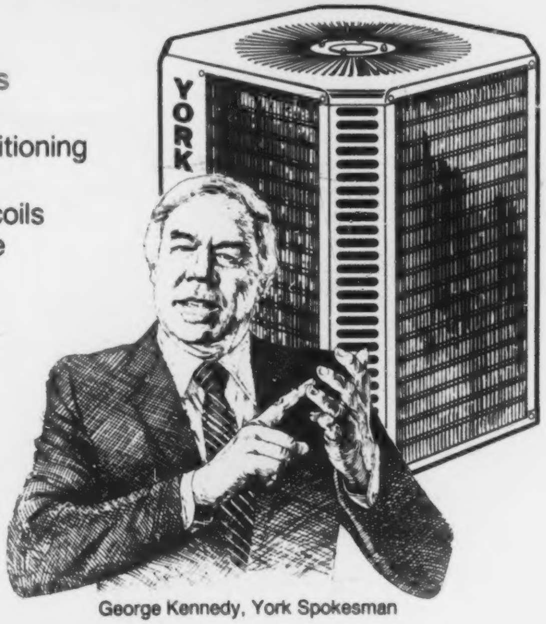
Circle 33

Stellar 2000™

PHASE II

More From One Of The Brightest Stars In The Industry

- New, 10.0 SEER cooling units (1½ to 3 tons).
- Full 9.0 SEER line of air conditioning systems (1 to 5 tons).
- Complete line of compatible coils and air handlers, including the Flat Top® coil
  —*a York exclusive.*
- Low-height—
  50½" upflow & counterflow furnaces and horizontal models.
- Patented YorkMate® Device
  —precisely controls refrigerant flow
  —lets you mix'n'match components.
- *Coming soon:*
  9.5 SEER heat pumps and more 10.0 SEER A/C units!



George Kennedy, York Spokesman

Stellar 2000—A complete line of heating and cooling systems—that can give a rocket boost to your sales.

The right decision.™

YORK®

Heating and Air Conditioning

Circle 70

April 7, 1986
Vol. 167, No. 14, Serial No. 2974

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Air Conditioning, Heating & Refrigeration News (ISSN 0002-2276) published 52 times a year by Business News Publishing Co., Edward L. Henderson, Chairman, P.O. Box 2600 (755 W. Big Beaver Rd.), Troy, Mich. 48007. Telephone 313-362-3700, Telex 23-0295.

Subscription Price: $44 per year (U.S.).

Microfilms of The News are available from University Microfilms, 300 N. Zeeb Rd., Ann Arbor, Mich. 48103.

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Second Class Postage Paid at Troy, Mich. and at additional mailing offices.

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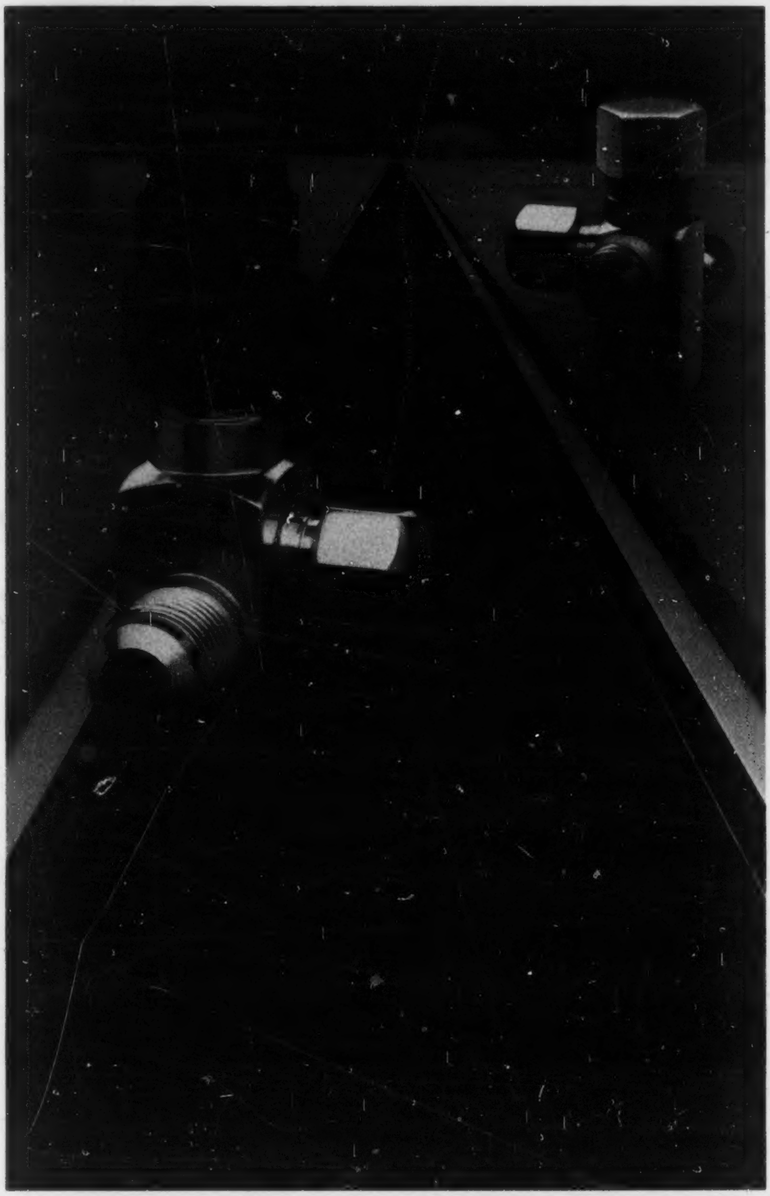

Steel or brass. Primore shut-off valves for air conditioning and refrigeration systems carry a special assurance of precision—and a record of delivering quality that goes far beyond others. They are designed to exact specifications and stringent quality control procedures. Whether steel or brass, plan on getting exactly what you need—the best of both, from Primore. Contact Primore Sales, Inc., P.O. Box 605, Adrian, Michigan 49221 U.S.A. Phone: 517/265-6168. TWX: 510/450-2500.

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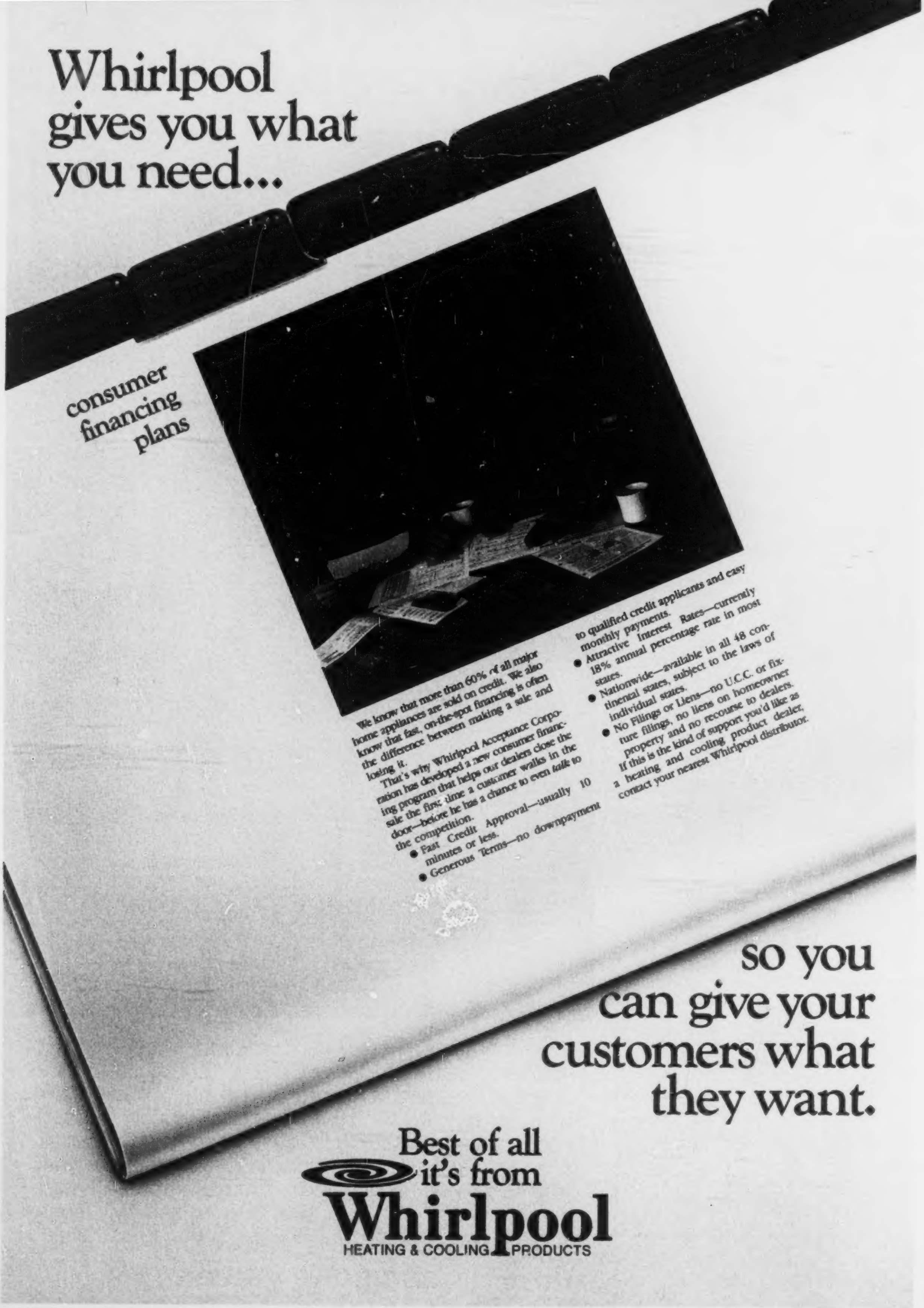

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plans

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If this is the kind of support you'd like as a heating and cooling product dealer, contact your nearest Whirlpool distributor.

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can give your
customers what
they want.

Best of all
it's from
Whirlpool
HEATING & COOLING PRODUCTS

THE NEWS
AIR CONDITIONING, HEATING AND REFRIGERATION
THE INDUSTRY WEEKLY

STATISTICAL PANORAMA

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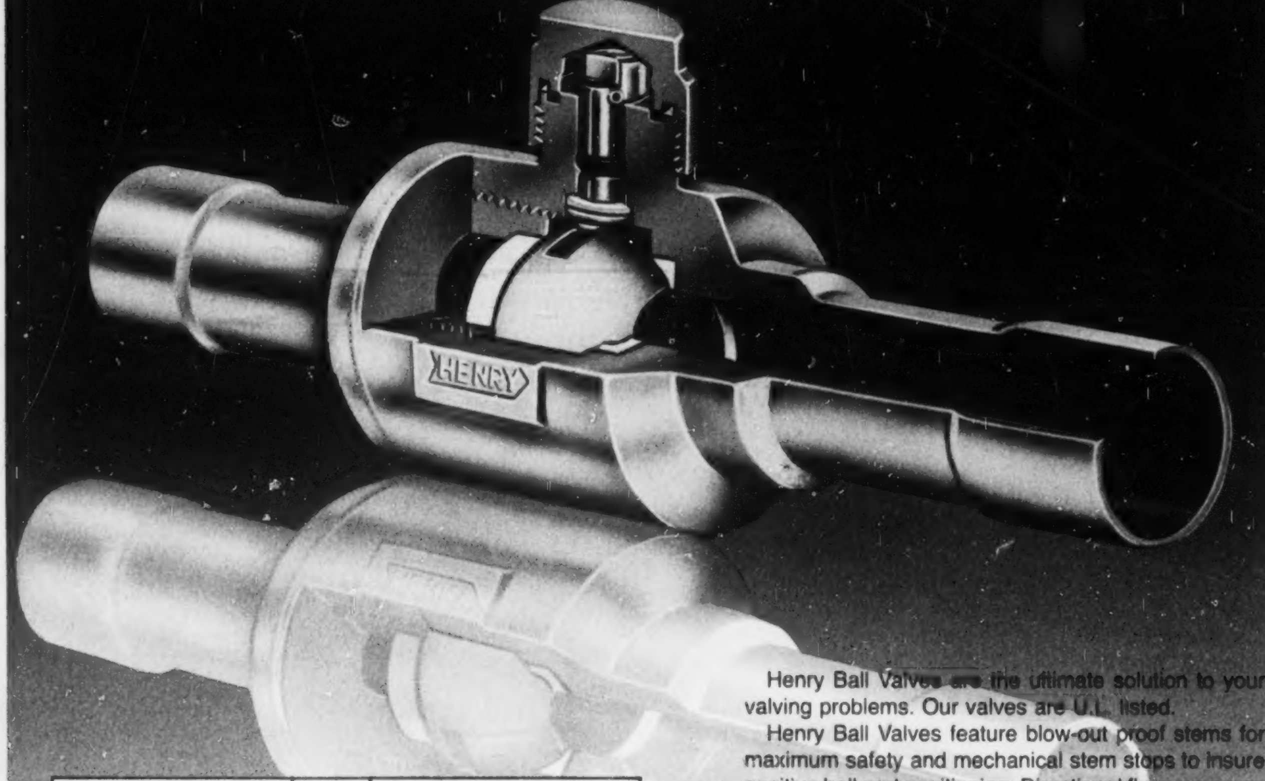
HENRY Ball Valves

The Ultimate



Henry Ball Valves are the ultimate solution to your valving problems. Our valves are U.L. listed.

Henry Ball Valves feature blow-out proof stems for maximum safety and mechanical stem stops to insure positive ball port positioning. Directional flow arrows on body and stem top provide fast, easy indication of flow direction.

Henry Ball Valves have more flow than conventional valves. Optional, quick opening lever handle available, patented design provides seal cap protection.

Henry Ball Valves have been rated by an independent testing laboratory. Their C.V. Factors are as much as **5 times** that of conventional standard valves. Specify the ultimate Ball Valve in your next system — specify Henry Valve.

U.S. Patent #3970285

Features	HENRY	COMPETITORS			
		"A"	"B"	"C"	"D"
Welded End Connection Design	YES	No	No	Yes	No
Mechanical Directional Stem Stops	YES	Yes	Yes	No	No
Blow Out Proof Stem	YES	Yes	No	No	No
UL Listed	YES	Yes	Yes	No	No
Published Flow Data	YES	No	No	Yes	Yes
Brass Ball	YES	No	No	No	No
Optional Lever Handle	YES	No	No	No	No

Available in sizes from ⅜" to 2⅛" O.D.

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Circle 24

9111-10

CARRIER WEATHERMAKER: FROM ZERO TO 97.3 IN FIVE YEARS.

BUILDING THE 97.3% PERFECT
EVEN FOR CARRIER.

BEYOND EFFICIENCY.

97.3%

A.F.U.E. And there's much more.

Our 58SX WEATHERMAKER® gas furnace has A.F.U.E. ratings as high as 97.3%. Every model is at least 91% efficient. But these days, it takes more than a super-high A.F.U.E. to send your customers scurrying for their checkbooks. So we're glad we took our time engineering the WEATHERMAKER. It's nearly perfect in a lot of other ways, too.

WE ALSO CONDENSED THE PROBLEMS.

Building a furnace with over 90% A.F.U.E. isn't all that hard. Condensing flue gases is easy. But doing that without causing big problems for the contractor is tough.

That's why some of our competitors settle for high noise levels. Some want you to pay a big price. Some think that a virtually uncleanable plate fin condensing section is a good idea. Some think a condensing furnace should be huge. And some make you disassemble the whole furnace to make a "simple" repair.

To which, we say "phooey."

When you buy a WEATHERMAKER, you still have to pay for it – but not so much. You still have to sell it – but that's a lot easier. You still have to install it – but it goes in fast. And if you service it, you won't need six hands, three days, and a Ph.D.

Our Weathermaker Furnace. Neat. Clean. And right.

THE CLEAN SLATE.

We got the WEATHERMAKER right because it's more than a conventional furnace with a few extra parts shoved in. That's why the WEATHERMAKER shares its primary heat exchanger with no other furnace. Ditto, its condensing heat exchanger. Ditto, its inducer blower. Ditto, its control system. Ditto, its sealed burner assembly. Ditto, its exclusive three-channel condensate drain.

THE LOGIC.

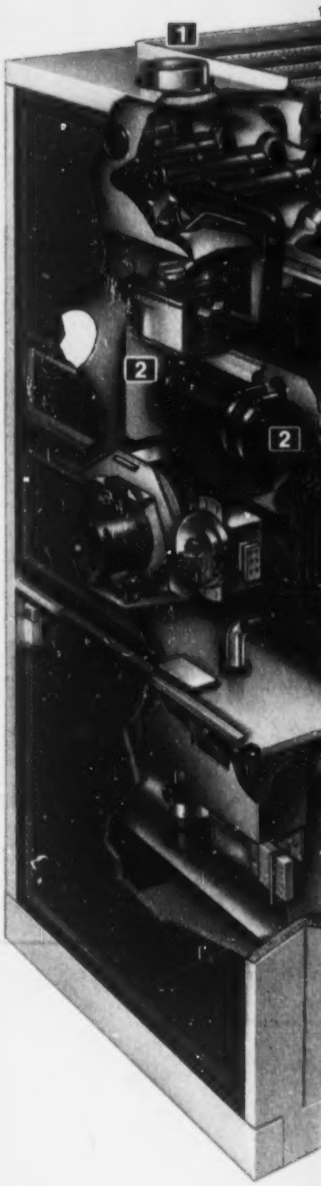
Look at most condensing furnaces, and you'll see combustion gases following a path that looks like a road map of Los Angeles. Because we started from scratch, we made the flow path logical. And that makes the furnace simpler and easier to work on.

For most efficient heat transfer, household air should start with the coolest part of the heat exchanger, then progress gradually to the hottest part. That's just the way it happens in the WEATHERMAKER. Combustion gases flow continuously downward. Household air flows continuously upward. This sort of neatness delights our engineers. So we're not surprised that contractors like it too.

THE LITTLE GREY CELLS.

No, not brain cells, though we used a lot of those designing the WEATHERMAKER. Condensing cells. Stainless steel miniatures of our unequalled Super S heat exchanger cells.

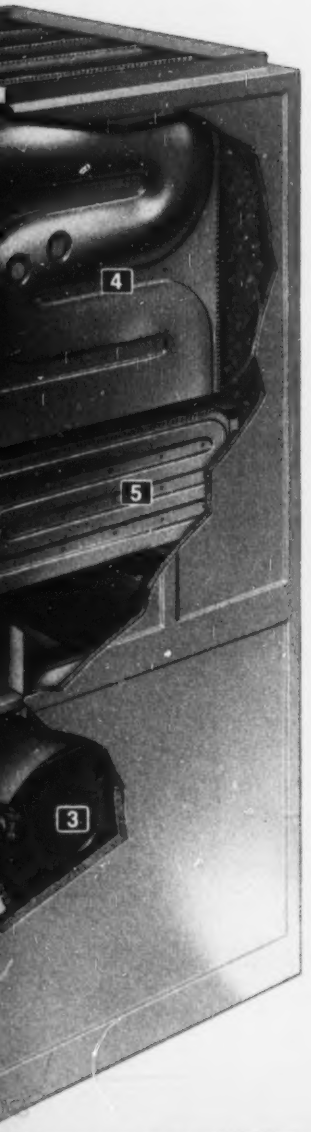
That's the way to go if you like simplicity. Easy cleaning. Low static pressure drop. And low blower electric consumption. No other company has 'em.



THE ILLUSTRATED WEATHERMAKER

Above, a lesson in clean design. Outside air is drawn in at the top (1). Combustion air is vented to either side (2). Our high-efficiency PSC blower motor (3) takes it easy: airflow around both primary (4) and condensing heat exchanger cells (5) is smooth and unrestricted.

FURNACE TAKES TIME.



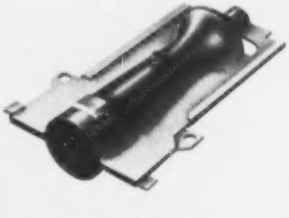
20 YEARS.

20 YEARS

Like all our top-line furnaces, the WEATHERMAKER has a 20-year limited warranty on the heat exchanger (both primary and condensing cells).

THE DATA.

Model	Btuh Output	AFUE
58SX040-BC-1	40,000	97.3%
58SX040-CC-1	41,000	92.2%
58SX060-CC-1	61,000	92.6%
58SX080-BC-1	81,000	91.4%
58SX100-CC-1	102,000	92.4%
58SX120-CC-1	121,000	91.0%



Monoport inshot burners.

THE BREATH OF FRESH AIR.

Laundry chemical fumes? Aerosol propellants? Why take chances. Condensing furnaces usually last a whole lot longer when they breathe outside combustion air. So the SX uses outside combustion air. Anything else is asking for trouble.

143 CHOICES.

We know. Contractors do not live by condensing furnaces alone. If you need a top-quality, high efficiency horizontal, we have it. Need a super-affordable standing-pilot counterflow? We have that, too. A dandy mobile-home furnace? A low-priced upflow with a 20-year limited heat exchanger warranty? We got 'em.

In all, we have 143 different furnace choices. So we're not just bragging when we say that we have what you need.

143.

THE QUIET.

Just listen.

THE PRICELESS INGREDIENT.

Simple: it's getting it right the first time. The result of five years of engineering development. Two years of field testing, using hundreds of hand-assembled prototypes. And a year of unprecedented success since the WEATHERMAKER introduction. It all adds up to a condensing furnace you can trust. What's more priceless than that?

CALL US.

Your Carrier distributor isn't selling dreams. He has a superb selection of 58SX WEATHERMAKER furnaces in stock right now. Call him. Or you can write to Richard S. Smith, Furnace Marketing Manager, Carrier Corporation, P.O. Box 4808, Syracuse, N.Y. 13221

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HEATING & COOLING

Coleman™

ON THE MO

Coleman Residential Heating and Air Conditioning is "On the Move!" We're committed to dynamic growth in the marketplace and making the changes necessary to get it.

ON THE MOVE with PRODUCTS!

Last year we introduced four new product lines, but "you ain't seen nothin' yet." This year we'll unveil dynamic, new heat pumps, air conditioners, furnaces and air handlers to broaden the line even more.

ON THE MOVE with DISTRIBUTION!

We're expanding our distribution. We got a good start last year and we want to finish the job this year. Like the Marines say, "We're looking for a few good men." So if you qualify, call us today.

If your current product line has you sitting still, get on the move with Coleman. We're going places!

GET "ON THE MOVE" WITH COLEMAN!

VE

ON THE MOVE with PROGRAMS!

Our unique distributor/dealer-oriented programs are designed to provide maximum flexibility for planning on a regional basis. And, our exclusive incentive trip program is second to none.

ON THE MOVE with PRICING!

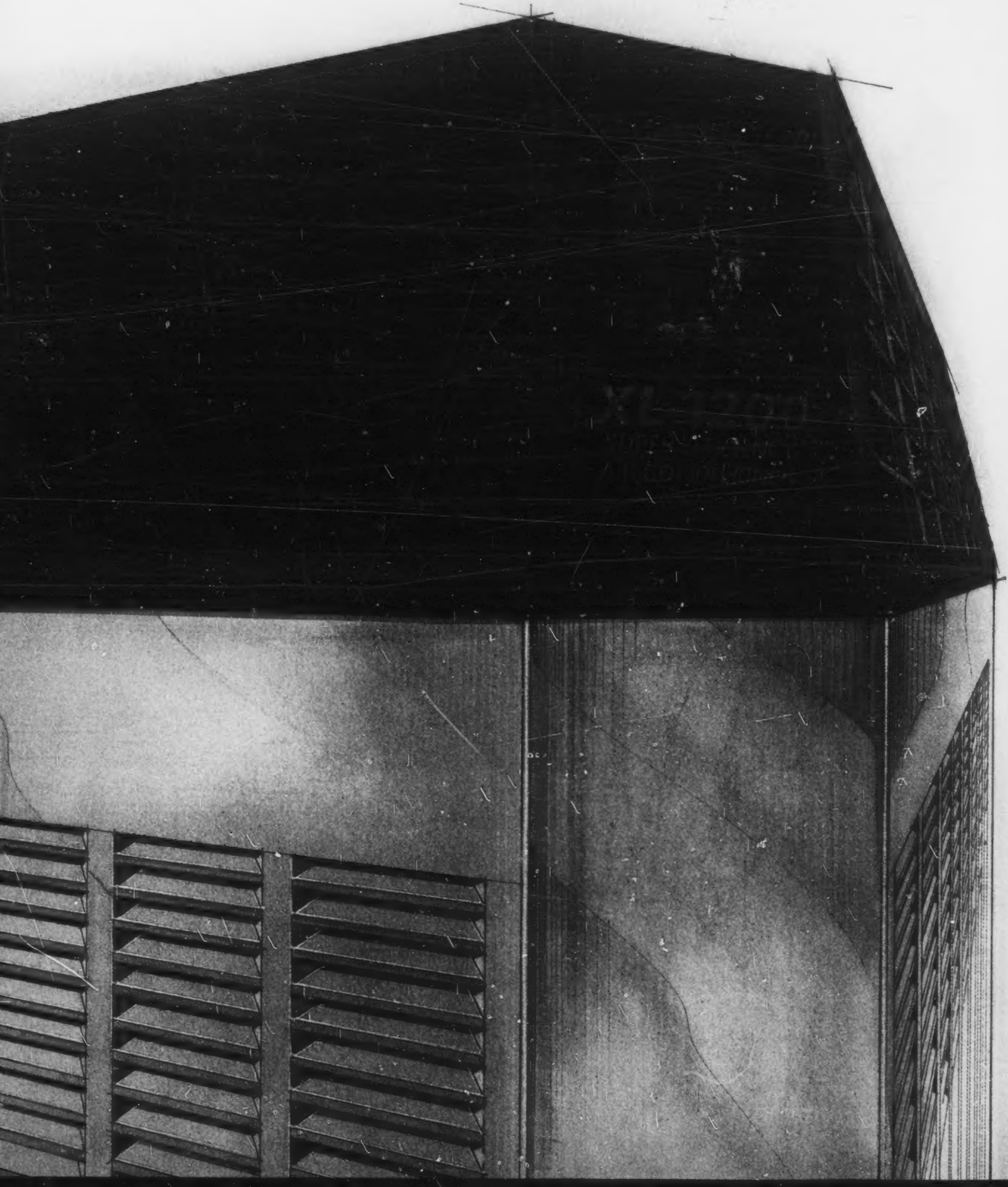
Coleman has made a major commitment to develop high-efficiency, high-quality products that are competitively priced. If you've checked the price of our 90 series gas furnace you know we're serious. You always knew Coleman was best, now you know it's affordably priced.

For more information contact:
The Coleman Company, Inc.
Residential Products Division
P.O. Box 1762, Wichita, KS 67201
(316) 832-6441

Coleman
HEATING & AIR CONDITIONING

Circle 8

INTRODUCING THE



RANE XL 1200.

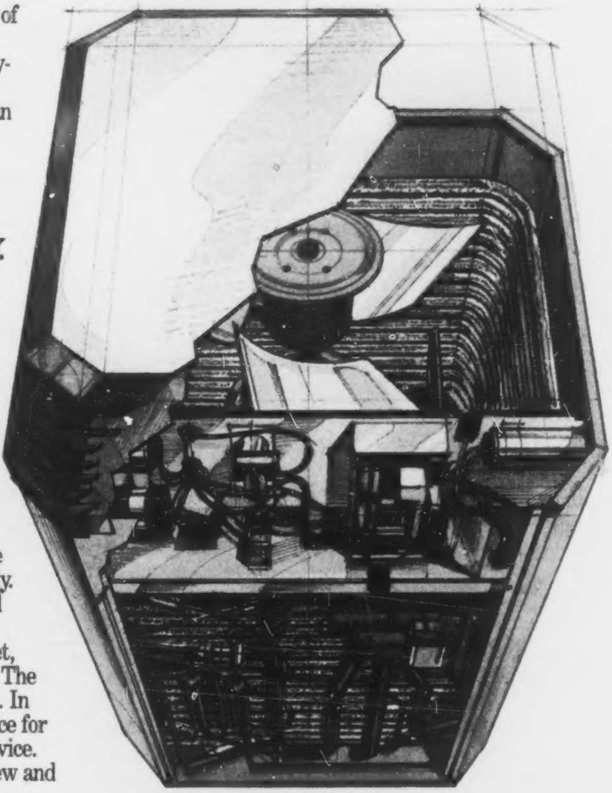
There's no missing the quality we built into our new XL Series of heat pumps and air conditioners.

Your customers will see it right away. In the rugged, smartly-designed Weatherguard™ top.

And in the energy savings. (It's up to 50% more efficient than old, inefficient units.*)

And by its exclusive 10-year limited warranty on the compressor and coil.

You'll see it too. The second you look inside.



DEMAND DEFROST MAXIMIZES EFFICIENCY.

The Trane XL 1200 Weathertron® Heat Pump ends unnecessary cycle defrosting. And with it, unnecessary strain to the heat pump. Our Demand Defrost is an electronic module that constantly monitors and adjusts itself to maximize system efficiency. It even has a light that flashes, signaling potential problems to the serviceman. Plus, a warning light on the thermostat tells the homeowner when a service call is needed.

THE CLIMATUFF™ COMPRESSOR. TOUGHER THAN EVER TO BEAT.

What could we possibly do to improve our compressor? Not much, admittedly. We've maintained all of its quality and durability features. While making it more efficient. And to make it quiet, we did give it a snap-on enclosure. The rotolock fittings are more accessible. In short, we made it easier to lift and to service for you. Then we made it even less likely to need service.

So from the inside out, the new Trane XL 1200 is truly a new and revolutionary product.

A WEATHERGUARD™ TOP, A PAINT JOB AND A TWO-SPEED FAN.

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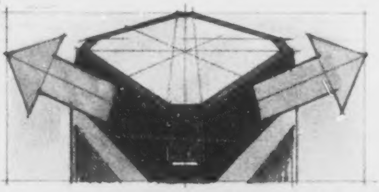

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FORECASTS

by Gordon D. Duffy and Thomas A. Mahoney

AIR CONDITIONING

Led by the continuing strength of both replacements and heat pumps, unitary air conditioner shipments in 1986 should top 3 million for the third year in a row. We've taken a conservative approach and forecast a total of 3,340,000 units, up only 1.5% from last year. Hot weather in early summer and a surge in new home starts, however, could push the total to 3.5 million. A steady light commercial market and low inventory levels add stability.

HEAT PUMPS

The heat pump, which has been capturing three of 10 new single-family home starts and an even higher percentage of multifamily units, continues strong. Replacements are not a major factor. But because nearly half of new home starts still are in the South, where lowering natural gas prices have the least effect, heat pump shipments should reach 840,000 units this year, up 2.4% from 1985's record performance.

FURNACES

Despite a modest increase in electric furnace shipments this year, we expect the total for gas, oil, and electric furnaces to be flat at 2,360,000 units. Replacements, the heart of this mature market, will continue to be strong. But the bonus market of the last few years — replacements for the sake of efficiency — is being blunted by lower fuel prices. The losses in this market segment, although modest, should be compensated by gains in new construction.

BOILERS

The residential boiler market is small when contrasted with furnaces. It has been dominated for many years by replacement sales and confined, in large measure, to the Northeast and Midwest. An increase in replacements and gains in new construction market share produced a 10% increase last year. This trend should continue in 1986 and bring an 8% improvement in shipments to 330,000 units.

CHILLERS

The demand for new office buildings, the driving force behind the chiller market, continues to be relatively strong despite ever-increasing vacancy rates. On the strength of new orders, we can expect a 5% increase in chiller shipments in 1986 to 12,400 units. We suspect, however, that this market may drop sharply by year's end.

ROOM AIR CONDITIONING

Domestic production of room air conditioners in the past two years has been affected as much by foreign competition as by the weather and competition from central systems. Exports, once 25% of shipments, slipped to 2.5% last year and imports swelled by 82% to 259,000 units. Look for more of the same in 1986 and a decline of 12% in U.S. factory shipments to 2,650,000 units.

COMMERCIAL REFRIGERATION

This market is difficult to predict because accurate statistics have not been available for many years. Continued strength in retail store and shopping center construction in the wake of new home construction, however, should keep this mature market strong in 1986. Remodels of existing supermarkets and convenience store expansion, too, should help maintain commercial refrigeration fixture shipments at about 95,200 units.

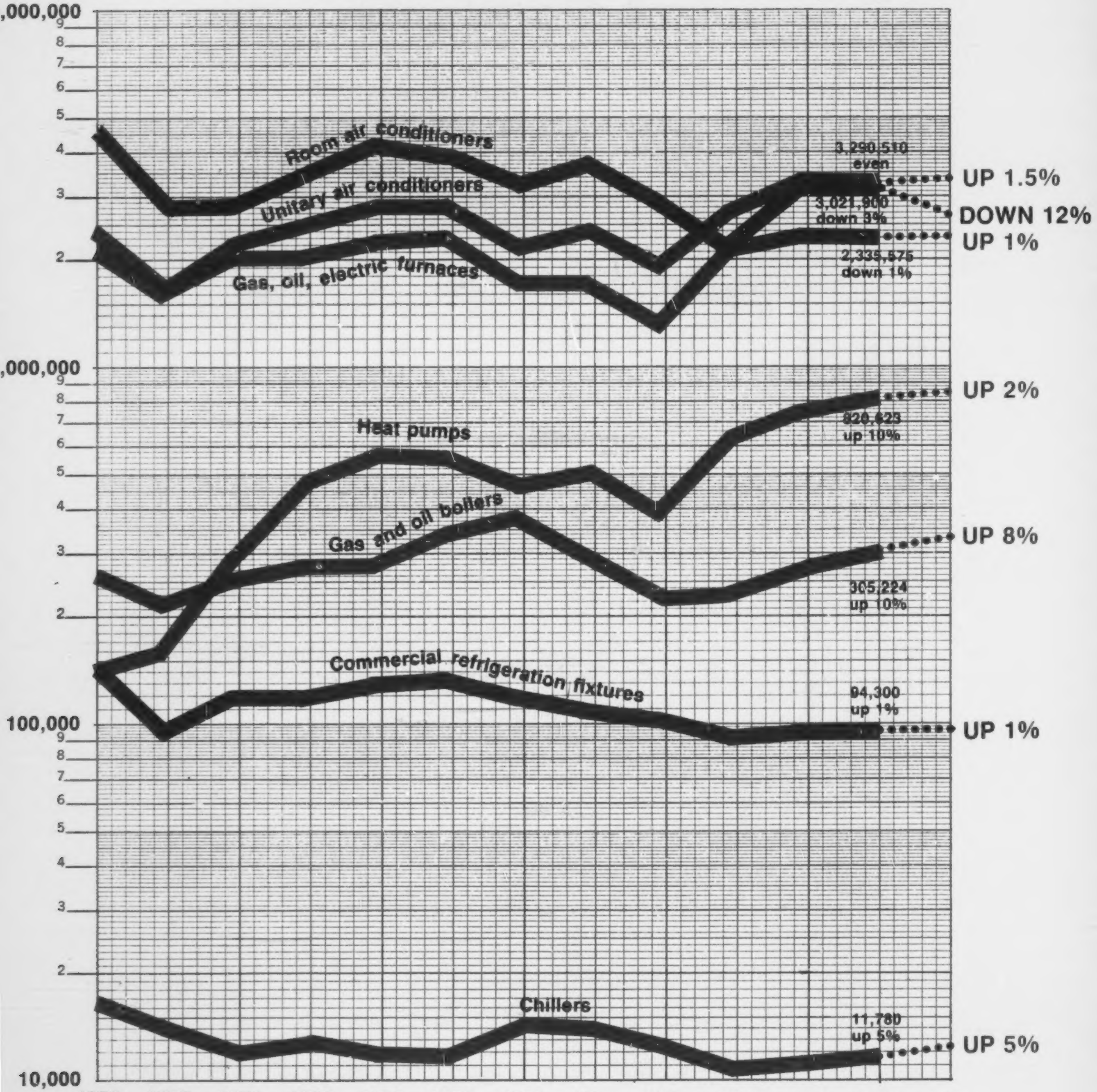
HOUSING

At first blush, the dramatic drop in mortgage rates after many years in double digits would appear to have the effect of literally driving housing starts through the roof. Tempering influences, however, are affordibility of single-family homes and the growing vacancy rate among multifamily rental units. We're looking for a total of 1,750,000 starts this year, which reflects a 10% drop in multifamily construction. We admit that we could be as many as 100,000 units low on the single-family side of the ledger if builders shift to lower-cost homes.

REPLACEMENTS

In the mature boiler and oil furnace markets, more than eight of 10 units shipped are replacements. Last year 55% of gas furnaces, or more than a million units, were replacements. About half of field-erected and commercial unitary air conditioner shipments now are replacements. And residential air conditioner replacements now total more than 900,000 units, or 45% of shipments. Taken together, they provide a steady base for the more volatile new construction market. The burning issue in 1986 is how replacements for the sake of efficiency will fare in the face of declining energy prices.

Industry trends



1986 IN PERSPECTIVE

In this fourth year of recovery from the deep recession early in the decade, business prospects for most of the contractors, wholesalers, and manufacturers in the industries served by this newspaper continue to ride the crest of a wave that promises to continue through this year and well into 1987.

And while there is no boom on the horizon, neither is there any hint of a downturn in either the U.S. economy or in the comfort heating-cooling or refrigeration industries. While shipment and installation growth curves may have flattened, it's important to note that most — particularly in home heating and cooling equipment — are at or near all-time highs.

Yet there is a definite feeling of unrest afoot. This year, more than any other in recent memory, there are a host of unresolved contradictions that have the potential to change the shape, if not the size, of markets in 1986 and in the years to come. Witness:

- The precipitous drop in world oil prices within the past few months to half the level of a year ago, coupled with an 8% decline in domestic natural gas prices and scattered reductions in the cost of electricity, surely will have an effect on the public's perception of high efficiency and energy conservation. What will be the extent of this impact and will it affect some products more than others?
- The dramatic drop in interest rates — particularly mortgage rates — to more realistic levels would appear to be the key to a floodgate of durable goods, new home, and manufacturing plant purchases. Yet consumer debt is at an all-time high, home affordability is paramount in an economy where home prices have outstripped wages by a wide margin, and industrial expansion has been blunted by imports and foreign competition.
- Uncertainty abounds over whether Congress will be able to deal with the twin political monsters of reducing the monumental federal deficit and tax reform. Although as individuals we may hope both will be resolved in this election year, we must also realize that they will almost certainly have a short-term negative effect on almost all types of construction.
- The continuing strength of the office building and multifamily home markets in the face of ever-increasing vacancy rates will bear watching even though, at this point, no bust is in sight. Foreign and domestic investment syndicates are heavily influencing office building, and tax shelter-oriented syndicates have become a major force in apartment construction. Few of these groups are particularly market-oriented. A side benefit is the additional pressure on other properties to renovate in order to stay competitive.
- While unitary air conditioner shipments promise to top the 3 million mark for the third year in a row, and furnace shipments again stay above 2.3 million units, there are signs that the margins characteristic of strong growth are eroding in a flat market. It's clearly a time when growth will come principally from gains in market share and competition at all industry levels will be keen.
- The growth of replacements has provided reassurance, especially in a maturing comfort cooling industry. But in this business segment, and in the others, the question of how many replacements were efficiency-driven should be answered within 18 months. Answered, too, will be the question of if, when, or how the Department of Energy will treat mandatory minimum efficiency levels for home heating and cooling equipment and other major home appliances.
- The U.S. air conditioning and refrigeration industry's net trade balance, once more than $1.5 billion, dropped another 32.8% last year to $647 million. The entrenchment of foreign competitors at home and abroad, together with a shift offshore of some domestic production, means it will be a long fight back even if the U.S. dollar is now 30% lower in relation to the currencies of other major trading nations.

The markets

Despite a growing dependence on replacements, the new home market continues to be an important influence. New home starts in 1985, at 1,723,300

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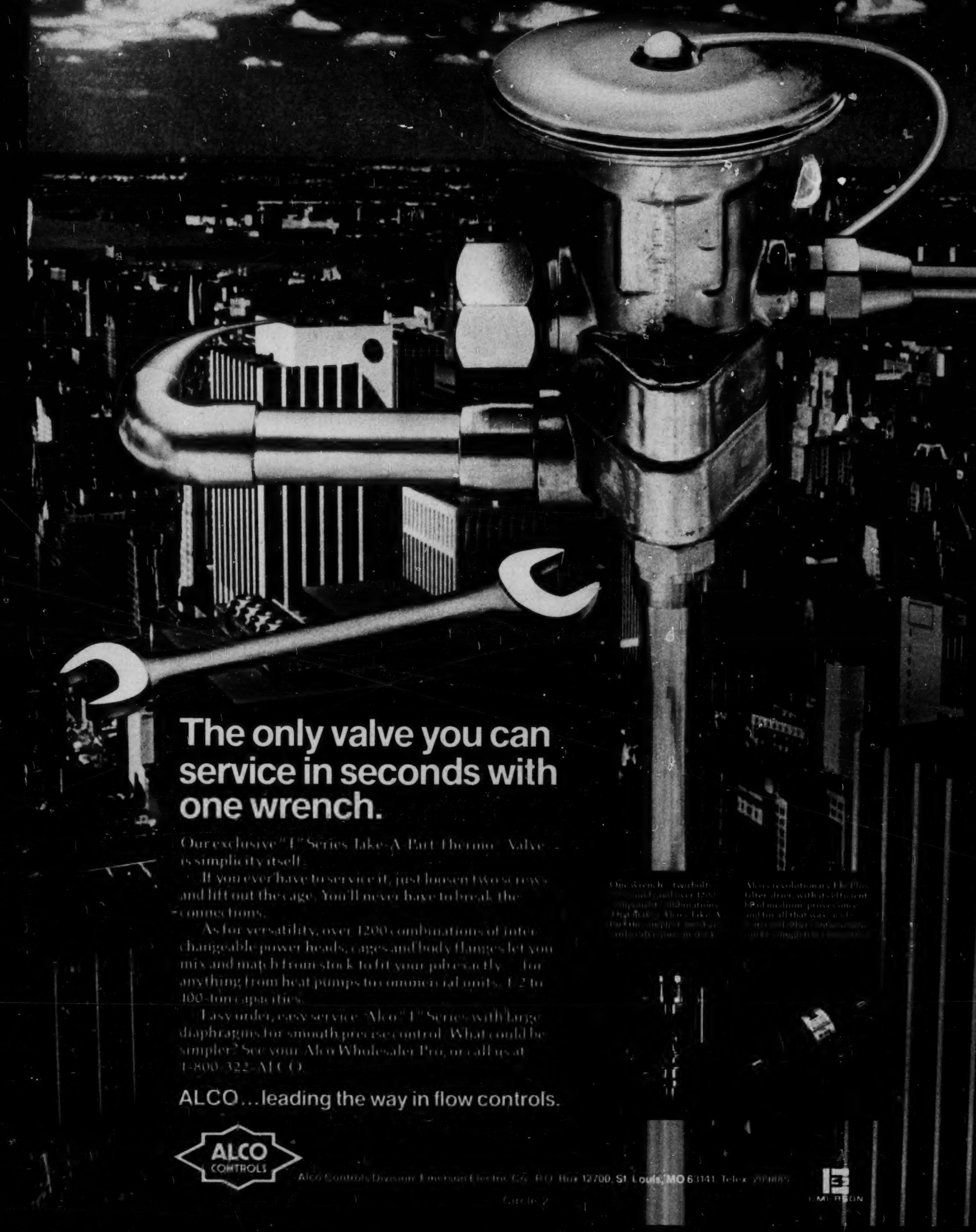

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'86 IN PERSPECTIVE

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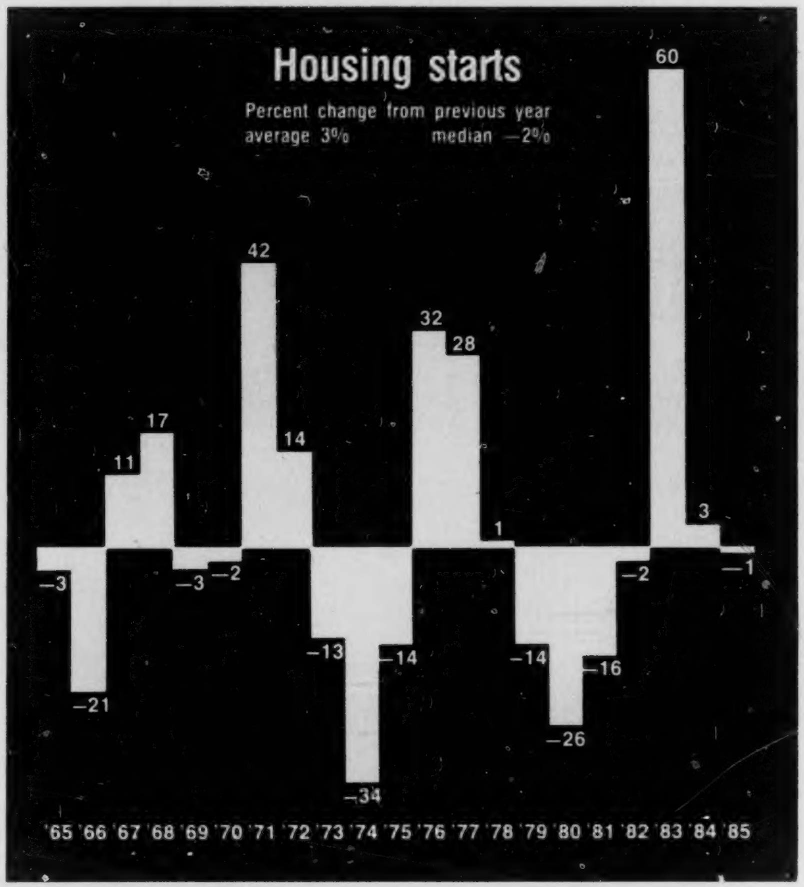


units, were only 0.5% behind the previous year's level.

Looking ahead, we forecast that new home construction will total about 1,750,000 units this year, up 1.6%. It reflects continued growth in the single-family home market and a 10.5% decline in multifamily starts.

While we don't anticipate any decline from these numbers, there are a couple of abnormalities that could add 100,000 units to that total. The reduction in mortgage interest rates to less than 10% in some markets has doubled (to 30 million) the number of families who can afford an $80,000 home in contrast with conditions of only a year ago.

On the multifamily home front, a bevy of tax shelter-oriented syndicates have been formed over the past 18 months to take advantage of the tax laws prior to tax reform. Experience has shown that these syndicates, with an inherent obligation to build, are often oblivious to the rising vacancy rates in many communities. Contractors and others should take care to get paid promptly in these cases.

Office construction, as we noted earlier, is a paradox. For the past five years, new office buildings have been added at an average rate of 300 million sq ft a year, yet the market has been only able to absorb about 250 million sq ft a year. Vacancy rates of 15%, or three times the 1981 level, so far have affected mostly older buildings as tenants shift to new downtown high-rises and suburban low-rises.

There are two major reasons for this strength, as we see it. Office building ownership is rapidly changing away from longtime local owners to real estate holding companies representing syndicates of investors. Foreign investors, particularly from the Middle East and Third-World countries, also are looking for investments in a secure environment.

There are many who feel the bubble soon will burst. It likely will burst, but probably not in 1986. We expect office building construction to decline by about 12% from 310 million sq ft in 1985 to about 273 million sq ft this year. The best markets will be in California, Texas, and Illinois will lead the parade.

The light-commercial market, led by shopping center construction, should continue to hold steady at about 548 million sq ft in 1986. A strong housing market and fast food restaurant expansion also are major contributors. The best markets: California, Texas, and Florida.

The market for educational buildings, at 92 million sq ft, should increase by 3% in real terms this year. California, Texas, and and Illinois will lead the parade.

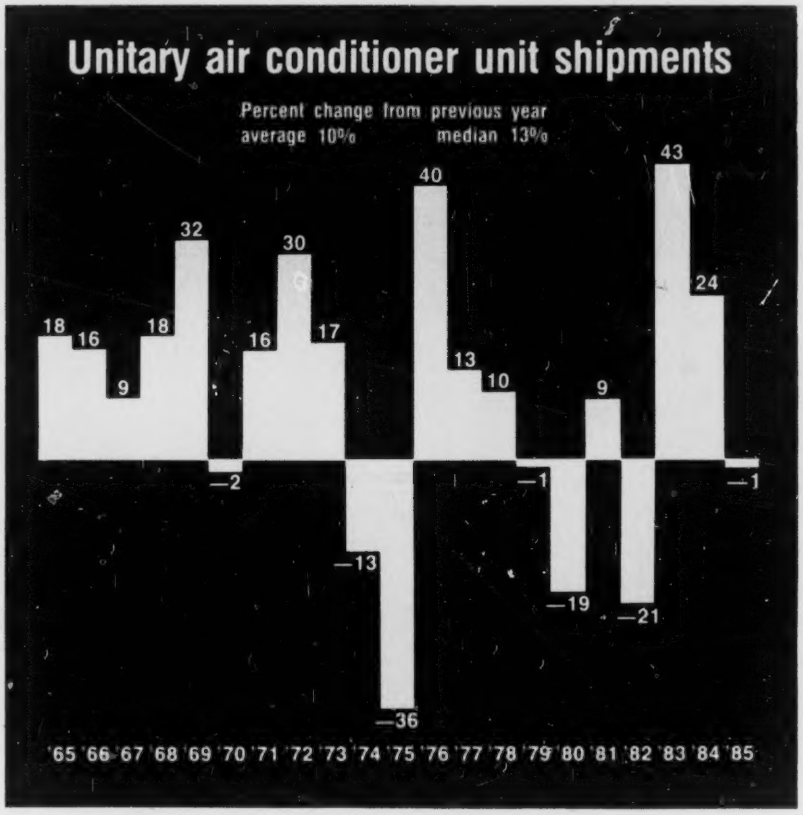
Hospitals and health-related construction, at 70 million sq ft last year, will remain flat. But there will be increases in New York, California, Virginia, and Pennsylvania. The value of publicly owned construction increased by 9% last year and should increase by another 3% in 1986. The best markets: Texas, Illinois, Michigan, and Louisiana.

Despite tax incentives and an increase in capacity utilization from 69% in 1982 to 83% last year, industrial construction has lagged. Stiff competition abroad and a flood of imported goods at home have influenced many to delay capital expenditures.

The 30% reduction in the value of the dollar in relation to the currencies of other major trading nations, particularly Japan, is not expected to result in a significant change in U.S. industrial exports for at least 18 months. Agricultural products probably will be the first to benefit.

Industrial construction increased by 12% last year to 140 million sq ft. New construction was supplemented by considerable modernization as manufacturers struggle to become more competitive — an effort that will be helped by the reduction in fuel prices. Look for a 4% increase this year, particularly in Michigan, Pennsylvania, Colorado, and Arkansas.

On a more optimistic note, the Conference Board reported in March that the thousand largest manufacturers plan to spend $108 billion on new



plants and equipment in 1986, up from $100 billion in 1985. The biggest gains will be in the aerospace, rubber, and food industries.

Comfort industries

Shipments of unitary air conditioners in 1985, at 3,290,510 units, missed by 0.5% equalling the 3,308,428-unit total of the previous year, the first in which the industry shipped more than 3 million units. Hardly a shabby performance.

Heat pumps were the stars of the unitary show last year. They eclipsed the record 1985 total of 745,195 units by 10.1% to set a new record of 820,623 units. Cooling-only unit shipments slipped marginally but the difference was all but made up by heat pumps on the strength of the new home market. Heat pumps captured more than 30% of new single-family homes started last year and, we suspect, close to 40% of multifamily units.

Looking ahead, we feel that the new home market will carry heat pumps to an 840,000-unit year in 1986, a 2.4% increase. Total unitary shipments should reach 3,340,000 units, up 1.5%. It will be the third year in a row the industry will have shipped more than 3 million units.

Nor are there thousands of units hidden in somebody's warehouse. Traditionally, inventories have averaged between 30% and 33% of shipments. In 1984, inventories were only 26% of shipments and, last year, slipped to 24% despite a proliferation of lines in two or three efficiency ranges.

Efficiencies of equipment as well as efficiencies of distribution increased last year. The Air-Conditioning and Refrigeration Institute (ARI) reported that, of 1985 shipments, the sales-weighted average of all cooling-only units of 65,000 Btu and was under 8.82 SEER (seasonal energy efficiency ratio), up from 8.66 a year earlier.

Similarly, the sales-weighted average for all unitary heat pumps in the same size range shipped last year was 8.56 SEER, up from 8.419 a year earlier. In the light of future state mandatory minimums adopted and proposed, however, it is significant to note that only 38% of cooling-only units and only 24% of heat pumps shipped last year had SEER's of 9 or better.

Influenced by the slight market share drop experienced by gas furnaces, shipments of gas, oil, and electric furnaces declined marginally in 1985 to 2,335,575 units from 2,351,600 units in the previous year.

The size of the gas furnace market, which declined by 1.5% to a still-respectable 1,822,295 units in 1985, overpowered the 0.5% gain made by oil furnaces (to 147,260 units) and the 3.3% gain made by electric furnaces (to 366,020 units). The combined market will grow by only 1% in 1986 despite modest gains by electric (5%) and oil (2%) furnaces.

Gas- and oil-fired boilers, on the other hand, experienced a slight increase in market share and shipments in 1985, at 305,224 units, 10.1% ahead of the previous year's total of 277,216 boilers. Look for an 8% increase this year to 330,000 units.

The Gas Appliance Manufacturers Association (GAMA) also has been keeping track of gas and oil furnace shipments in terms of efficiency. This is especially significant since it was only in 1984 that most manufacturers could offer furnaces in a full range of efficiencies.

Five years ago, before the dramatic improvements in gas furnace efficiencies, virtually all had AFUE's (annual fuel utilization efficiencies) below 65%. Last year, only 14.9% of shipments were in this category.

Also last year, 31.3% of shipments were furnaces with AFUE's of 80% or better. That was 569,000 units. Of these, 223,000 gas furnaces, or 12.3% of total shipments, had AFUE's of 86% or better. It should also be noted that shipment percentages for these top two efficiency categories changed little since 1984.

Similarly, 34.9% of oil furnaces shipped last year had AFUE's of 80% or better. Oil furnaces with AFUE's of less than 75% accounted for only 9.5% of the market, although this segment increased in the past year.

In other product segments, commercial rooftop heating-cooling unit ship-

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ments increased by 5.3% last year by our reckoning to 142,250 units. That market should remain flat in 1986.

The chiller market, which increased by 5% last year to 11,780 units, should increase by another 5% in 1986 on the strength of orders already received.

The commercial refrigeration fixture market, always hard to track, appears to be holding steady at about 95,000 units.

But the new construction market, once the long suit of unitary air conditioning, is not the whole story.

Replacements

The replacement market has long been an important consideration for heating equipment. It's only in the last few years, however, that it has started to dominate the comfort cooling market — a factor that's changing the way contractors and manufacturers approach their business.

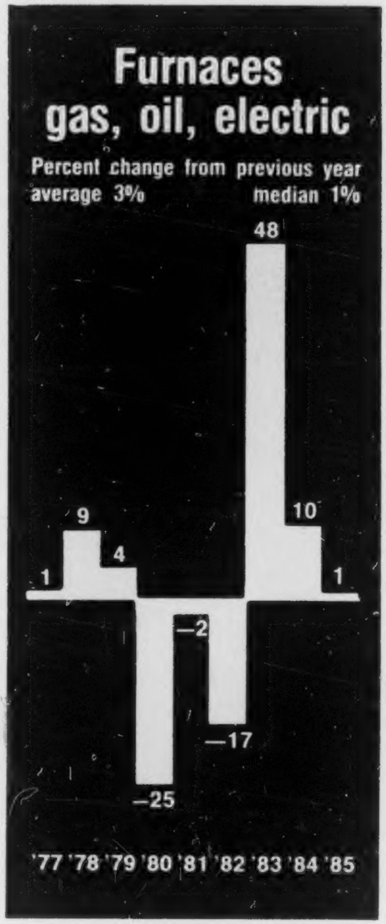
In more specific terms, many construction-oriented contractors have regarded service as a necessary evil. They are finding out today, however, that their service operation is the driving force behind replacement sales. And manufacturers are finding, too, that the contractor is an important partner in the quest for replacement sales.

In 1985, for example, we estimate that 45.5% of residential air conditioners shipped were replacements. That amounted to 909,400 units, or nearly 200,000 more than went into new construction. This year, replacement central air conditioners will top 920,000 units.

Residential heat pumps, a relatively recent market phenomenon, has a much smaller share of the replacement market. We estimate that about 17.5% of shipments, or 130,000 units, were replacements.

In the case of commercial unitary equipment, we estimate that about half, or 234 600 units, were replacements last year. This total does not include another 8,000 replacement commercial heat pumps. Manufacturers tell us that half of the chillers destined for field-erected systems today are replacement units.

Replacements have been a driving force in the home heating market for many years. We estimate that more than 1 million gas furnaces, or 55% of shipments last year, were replacements. A total of 253,400 gas- and oil-fired boilers, or 83% of shipments, were replacements. Another 129,300 oil furnaces, or 88% of shipments, were replacements. They were supplemented by another 258,000 replacement oil burners.



Fuel prices

The prices charged for natural gas, oil, and electricity detailed elsewhere in this issue reflect the situation in November, 1985, simply because they were the latest detailed figures available. They are misleading because, even as you read this, the ground is changing beneath our feet.

The world price of oil, which averaged $35.49/barrel in 1981, had slipped to $23.73 by Jan. 1, 1986, but many OPEC (Organization of Petroleum Exporting Countries) and non-OPEC nations already were undercutting that price.

Saudi Arabia, which had cut production from 9.9 million barrels/day in 1980 to 2.5 million barrels/day last year in order to keep the price up, admitted late in 1985 that its policy had backfired. Not only were OPEC nations cheating, but the high prices had fostered new finds and new markets for non-OPEC nations. Meanwhile, Saudi earnings from oil had dropped from $109.4 billion in 1981 to $28 billion last year.

Fed up, the Saudis have increased oil production to 4.5 million barrels/day, have drastically cut prices, and have threatened to increase production to 9 million barrels/day if that's what it takes to regain market share. The result has been a weighted average world oil price on March 4 of $23.73/barrel and spot market prices below $15/barrel.

When the dynamics sort themselves out, many believe the price of oil will settle somewhere between $15 and $18/barrel and hold there for at least five years. Not only will this have a dramatic effect on gasoline and fuel oil prices in the U.S., but the effect on competitive fuels also will be important.

For example, the cost of residual fuel oil dipped below that of natural gas on a fuel-equivalent basis in 1983 when the price of residual oil was about $30/barrel. Industrial and electric power boilers, almost all of which have dual fuel capability, began to switch from gas to oil.

Until this year the natural gas industry, which sells 44% of its output to these two markets, had marched just below residual oil on a Btu-equivalent basis. American Gas Association reported it had reduced prices by 8% last year. Most of this, we suspect, came in an effort to compete with residual oil which, in the U.S., dropped in price from $29.50/barrel in January, 1985, to $23/barrel in January of this year. But by Feb. 28, the price of residual oil in the U.S. had dropped to $17.05/barrel.

The impact of these price reductions, although enormous, will not be known for many months. In all probability, we can expect more imported oil and, with the new Middle East refineries coming on stream, more imports of finished products. This will have a severe impact on U.S. refineries, already running at only 77% of capacity.

It probably will also mean a shakeout of U.S. natural gas wells and a capping of those with higher production costs. Shortages, however, should

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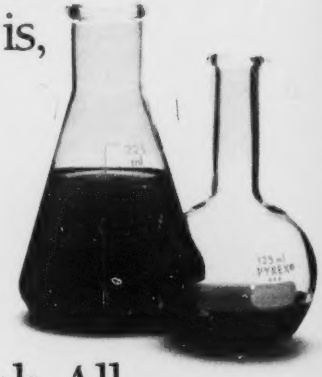

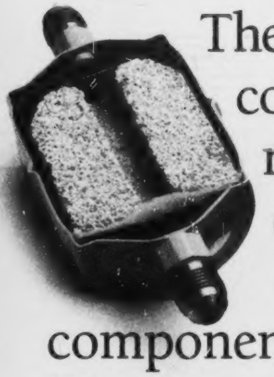

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not be part of the scene. Fuel oil prices, already 20% below peak levels, probably will fall by another 15% to 20%.

Electric utilities, which last year depended on oil for only 4% of power generation, will not be affected greatly except where electricity competes directly with natural gas in markets such as space heating. Even here, prices last year decreased in some markets. Because of debt considerations, however, electricity prices are expected to increase marginally until the end of the decade, then decline slowly in real terms.

Industry impact

The impact on the industries served by this newspaper, as we see it, will be uneven and will be caused as much by consumer perception of the future as by the change in prices themselves.

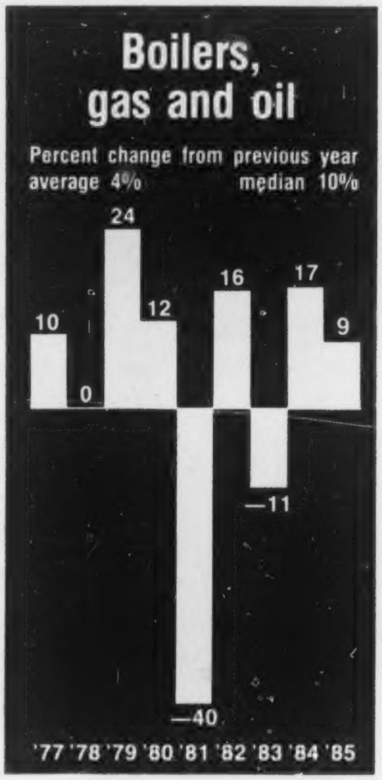
To be more specific, we think unitary air conditioning will be affected the least in the short term. Electricity prices are not likely to come down appreciably and, particularly in the South, operating costs will continue to be of real concern.

This means that the trend toward higher efficiencies probably also will be sustained. It's probable that the utility incentives for efficiency, an important force in this development, also will be continued. The utility incentive to postpone the addition of future generating capacity will remain.

Heating equipment market shifts, at least in the short term, are not likely to be extensive. Oil should make some gains in the Northeast, where it is already strong and natural gas prices are high, but the lack of a distribution network will confine this change to the Northeast and Midwest.

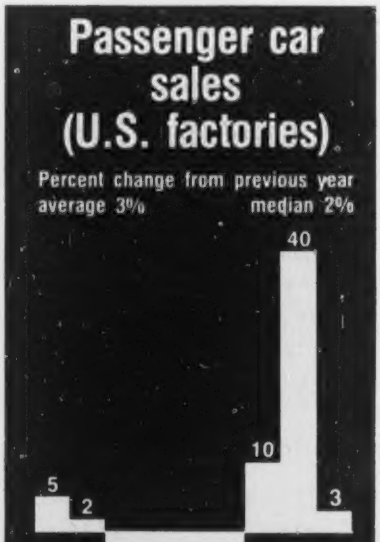
With the expected decline in natural gas prices, gas furnaces should make some gains against heat pumps and electric furnaces, but we suspect they will be modest and confined mainly to the northern states.

Of more importance to the furnace market is what the decline in fuel prices, and the consumer's perception of the future, will do to high-efficiency products. The portion of gas furnaces with AFUE's (annual fuel utilization efficiency) of 80% or better already appeared stalled at 30% of the market in 1985. This relatively new market could drop substantially in future years although we suspect that mid-range efficiencies, with a much lower first cost premium, will become the predominant segment.



Boilers, gas and oil

Percent change from previous year
average 4% median 10%



Passenger car sales (U.S. factories)

Percent change from previous year
average 3% median 2%

There is a significant sidelight to these changes in fuel prices that should not be overlooked. Virtually all consumers will save substantial amounts at the gasoline pump and most will benefit from lower fuel bills. This will mean a windfall of discretionary income that virtually every market segment in the nation will be chasing.

Not to be forgotten, either, are the real and proposed mandatory energy efficiency standards enacted by several states. In this climate of falling fuel prices, too, the Department of Energy this year will be trying to make up its mind — again — whether federally imposed mandatory minimums are necessary for comfort heating and cooling equipment and major home appliances.

And as Congress searches with increasing desperation for a way to reduce the federal deficit, a tax on imported energy products becomes more and more probable.

In fact, the implementation of the Gramm-Rudman budget deficit legislation holds the potential of having a severe negative impact on both the economy as a whole and construction in particular. How Congress reacts, especially in an election year, will bear close watching.

The economy

Although certainly not all that bad, the economy in 1985 appeared to be mired in a slow growth mode. More of the same is expected this year, the fourth year of recovery. If there is a silver lining, it is that no downturn in the cycle is on the horizon.

The gross national product (GNP), in real terms, increased by a modest 2.3% in 1985. Even though employment, industrial production, and retail sales have been improving, the widening trade deficit keeps dragging down overall performance.

The weakening of the dollar in relation to the currencies of other major trading nations, together with falling energy prices, should help both U.S. exports and manufacturing in 1986. The effect, however, probably will not be dramatic. The GNP should increase in 1986 by about 3.2%.

The 6.9% unemployment rate in December, 1985, was the lowest since 1980. A minimal decrease is expected

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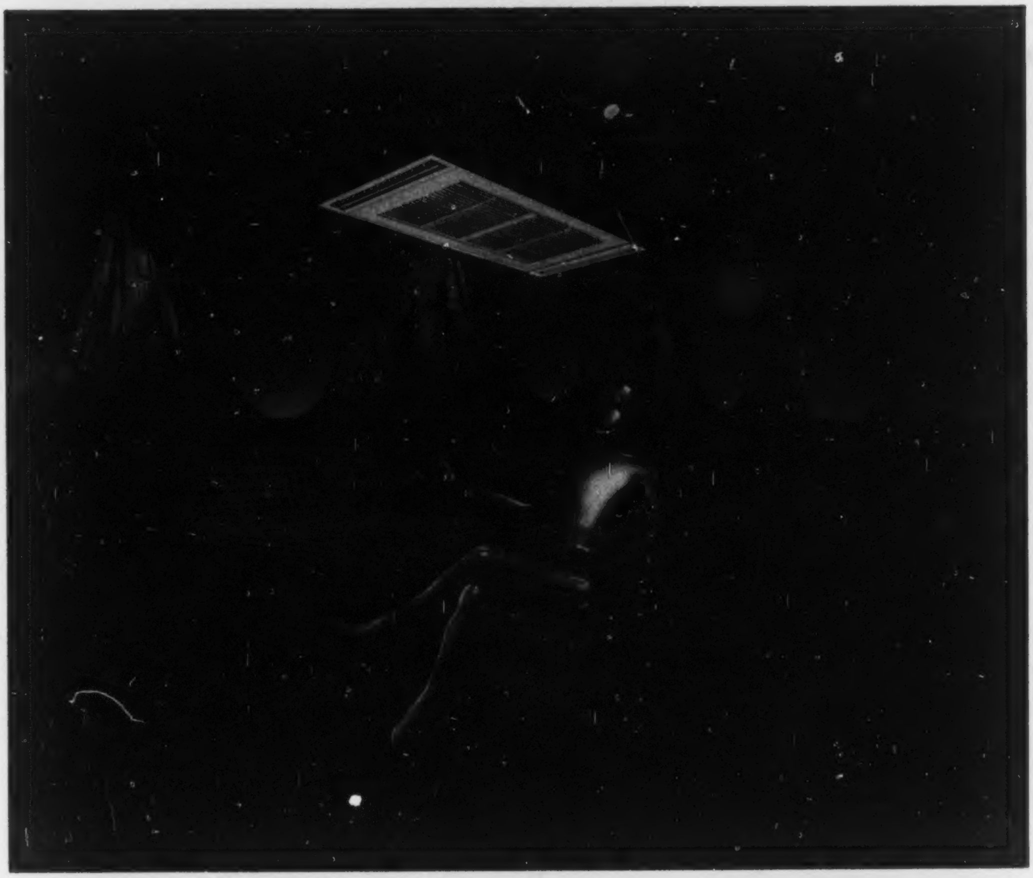

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this year because of the number of people coming into the labor market. At year's end 108.2 million people were employed in the U.S., up from 106.3 million in December, 1984.

The prime bank loan rate, at 10.5% early in 1985, had dropped to 9.5% a year later and, a month ago, dropped to 9%. The discount rate, the rate at which member banks can borrow from the Federal Reserve, also dropped in March from 7.5% to 7%.

Importantly, the effective home mortgage rate has declined from 12.75% in December, 1984, to 10.87% a year later. In March, some lending institutions were charging less than 10% for 30-year fixed-rate mortgages.

At the same time, however, per capita disposable income (in constant 1982 dollars) remained unchanged at $10,466 from 1984 through 1985. Real average weekly earnings declined by 1% and the savings rate declined from 5.9% of after-tax income in 1985 to 3.1% in December, 1985.

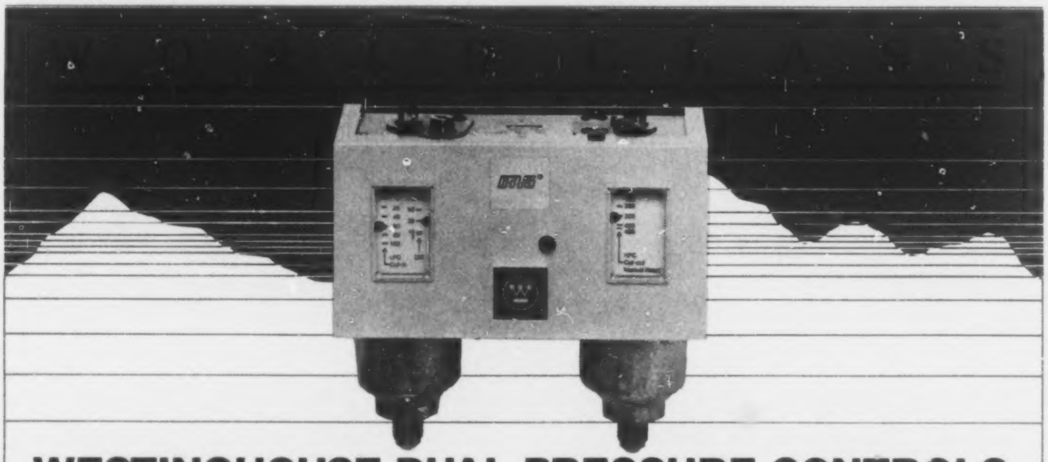
Lower gasoline and fuel prices should prompt a turnaround in these figures in 1986. But it should also be noted that consumer installment debt outstanding in November, 1985, totaled a record $537 billion, up 19.9% from a year earlier.

The consumer confidence index in February had slipped by one point from a month earlier and three points below December, 1985, according to the Conference Board. At that time, less than 30% planned to buy major appliances, down from 35% in January. In February, 4% planned to buy a new home, up from 3.7% in January, and 6.9% planned to buy an air conditioner, down from 7.3% a month earlier.

The board's measure of business confidence, based on an appraisal by business executives of present and future economic conditions, stood at 55 in the fourth quarter of 1985, up from 51 in the third quarter. The help-wanted advertising index was down two points to 143 in January but up by a similar margin from the 141 in January, 1985.

Although not detailed here, any appraisal of the economy in 1986 should also take into account the impact on U.S. banks of the precipitous drop in world oil prices. While it will make it even more difficult for oil-producing nations to repay their debt, it should also make repayment easier for some third-world countries.

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.



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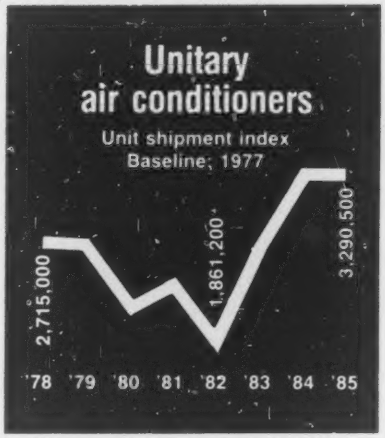
Circle 35

AIR CONDITIONING

If an industry has to have trouble with no-growth years, it's better that the flat spot in the curve be at the top rather than at the bottom. Such is the case with unitary air conditioners. Shipments last year came within a whisker of equalizing 1984's record performance and, in doing so, recorded only the second year shipments have topped the 3 million mark.

A steadily increasing replacement market and continuing electric utility efficiency incentives, together with a relatively strong new home construction market, contributed to unitary's market strength. It promises to continue unabated through the remainder of this year.

But not all were smiling. With the flattening of the market, competition has become much stiffer and margins were down in 1985 — a condition that promises to persist. Too, those strong in the South and in the heavily agricultural states continue to suffer. Their consolation is that the bottom appears to have been reached in both the energy-producing and agricultural states.



Total shipments of U.S. unitary air conditioners and heat pumps in 1985 dropped by only 0.5% to 3,290,510 units from the previous year's record-setting 3,308,428 unit total, according to the Air-Conditioning and Refrigeration Institute (ARI). The 1985 total was 76.8% higher than the recession-prompted total of 1.86 million units in 1982.

These figures do not include air conditioning units and air-to-air heat pumps shipped to foreign markets. In company with most other U.S. exports, exports of these units declined last year by 17% to 79,900 units from a revised total of 96,200 in 1984.

It must be remembered, also, that these export figures include only those units shipped directly to foreign destinations by oem's (original equipment manufacturers) and include few, if any, units shipped by distributors or contractors.

Of the 3,308,428 units shipped in

TURN TO NEXT PAGE

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AIR CONDITIONING

FROM PRECEDING PAGE

1984, about 81% — or 2,679,827 units — were for residential applications and 19% — or 628,601 units — were for commercial applications, according to ARI.

This ratio is slightly different than the 78%-22% split that held sway for more than a decade. But it is in sharp contrast to the ratio posted in 1953, the first year for which statistics were available. At that time, 66.9% of total unitary shipments went into commercial installations and only 33.1% went into homes. The residential share passed the commercial portion two years later and, in 1973, the 78%-22% split was achieved.

If we accept that the 1984 split held true in 1985, then 2,665,313 units — or 81% — were destined for residential applications and 625,197 units — or 19% — were destined for commercial applications.

The unitary category includes electric air conditioners, gas air conditioners, air-to-air heat pumps, and rooftop equipment. It does not include packaged terminal air conditioners (ptac's), packaged terminal heat pumps, room air conditioners, heat pump water heaters (air-to-water heat pumps), or water-source heat pumps.

Inventory

The inventory of unitary air conditioners at the end of 1985 totaled 800,462 units, down 7.7% from the total units in inventory a year earlier. As a percentage of total shipments, the 24% figure for last year was 2% less than in 1985 — and significantly lower than the 30% to 33% range considered normal throughout much of the industry's history.

This third year with relatively low inventories, particularly at the factory level, confirms a major improvement in distribution efficiency among both independent wholesale-distributors and factory branches. Forecasting programs instituted by both wholesaler organizations have been a significant factor.

Surveys conducted by The News, however, have begun to indicate some product shortages so it's unlikely that inventories as a percentage of shipments can drop much lower. Both oem's and wholesalers also must avoid getting caught with heavy inventories should the economy turn downward, a fear that probably won't be realized in 1986.

Of the total end-of-1985 inventory, a total of 321,676 units — or 40.2% — were at the factory and a total of 478,786 units — or 59.8% — were at the distributor level. By way of contrast, in 1983 the split was 49%-51% in favor of distributors.

Capacity mix

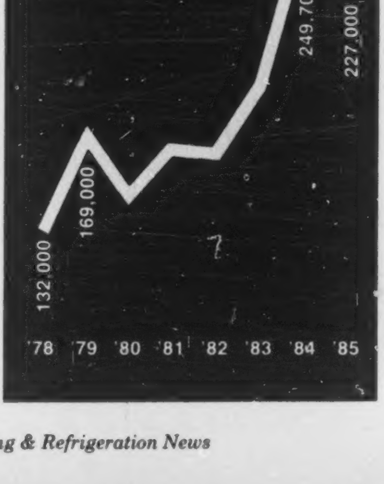
An indication of capacity mix for 1985 unitary air conditioners, and how it compares with 1972 experience, follows:

	% 1972	% 1985
Under 1.8 ton	16	14.6
1.8 ton to 26,999 Btuh	23	21.2
2.25 ton to 32,999 Btuh	17	17.0
2.75 ton to 38,999 Btuh	22	20.2
3.25 ton to 43,999 Btuh	6	6.9
3.67 ton to 53,999 Btuh	7	8.0
4.5 ton to 64,999 Btuh	6	7.7
5.4 ton to 96,999 Btuh	1	1.8
8.1 ton and larger	1	2.6

Installed Value

The installed value of unitary air conditioning equipment put in place in 1984, the latest year for which figures are available, was $8,963,353,000, up 25.8% from the $7,125,914,000 total for the previous year, according to ARI's Business Research Department.

Installed value covers the cost of unitary air conditioning equipment as shipped from the factory together with labor, ductwork, registers and grilles, thermostatic and other controls, electrical wiring, and other components of the system installed by contractors.



The installed value of field-engineered systems put in place in 1984 was estimated at $5,303,865,000, an increase of 9.7% over the prior year's total of $4,834,200,000.

The combination of the two installed value figures for 1984 was $14,267,218,000, an increase of 19% over the previous year's total of $11,960,114,000 for all comfort cooling systems (with the exception of room air conditioners) put in place in the U.S.

Comparing dollar values, unitary systems accounted for about 59% of the total in both 1982 and 1983. But in 1984 the unitary share climbed to nearly 63%, or closer to the 65% share it enjoyed in 1981.

In determining the installed value of field-engineered air conditioning systems, ARI estimates that only 7.5% of the cost of the system is represented by the refrigerating machine. The remaining 92.5% represents air handling equipment, labor, ducts, pipes, controls, and all other installation costs.

Ptac's

The upward climb of packaged terminal air conditioner (ptac) shipments took a dip of 9% in 1985 from 249,700 units in 1984 to 227,200 last year.

This product has become very popular in the hotel-motel, nursing home, and suburban office park markets, all of which softened considerably in 1985. In fact, ptac's compete head-on with commercial rooftops at the low-tonnage end of the market and with field-engineered central systems at the high end of the market.

And as the major manufacturers developed or acquired ptac lines of their own, they are no longer selling against the decentralized systems using ptac's.

Heat pump versions, known as packaged terminal heat pumps, accounted for nearly half of the total units shipped last year, down slightly from the 52% share a year earlier but still well above the 40% share in 1983. This is accounted for, in part, by the surge in construction in the Northeast and a relatively slow market in the South.

It might be noted that the Bureau of the Census reported that 278,329 ptac's were shipped in 1984, the latest year for which figures are available, up 33.3% from the 208,826 total shipped the previous year. Heat pump versions, which at 93,459 units in 1984 accounted for a third of the Census Bureau total, increased by 59% over the 58,753 heat pump versions shipped the year previous.

As can be seen, the Census Bureau figures vary considerably from those collected by industry. Some believe that it is because some room air conditioners have been inadvertently included on the government reporting forms.

Ptac's are self-contained refrigeration cycles capable of being combined with a heat source such as electric resistance heaters, steam or hot water coils, in the same through-the-wall cabinet. The heat pump version uses outdoor air as a primary heat source and may or may not contain supplementary hydronic of electric back-up heating.

Heat pumps

Air-to-air heat pumps, once considered creatures of the South and temporary expedients to natural gas curtailments, have shown surprising strength in both the residential and commercial rooftop markets.

Instead of fading into the background when natural gas became readily available at the turn of the last decade, heat pumps have increased their penetration, if only marginally, in the past three years. But as the gas industry knows only too well, heat pumps obviously have come to stay.

Shipments of air-to-air heat pumps in 1985 totaled 820,623 units for yet another record year. It represents a 10.1% increase over the previous record total of 745,195 units shipped in 1984. The total last year was more than double that of recession-riden 1982.

It might also be noted that, while shipments of straight cooling units declined by 3.6% (across a much larger base), heat pump shipments increased by 10.1% and, so, kept the total unitary decline to only 0.5%.

Clearly there has to be some explanation. Both single- and multifamily housing construction, the prime markets for air-to-air heat pumps, declined only marginally. The same was true for commercial heat pumps, at least in the sizes over 5 tons. Even if penetration in mobile homes increased substantially, the relatively small total for this market segment could not justify the heat pump increase. The replacement market, although growing, is still relatively small.

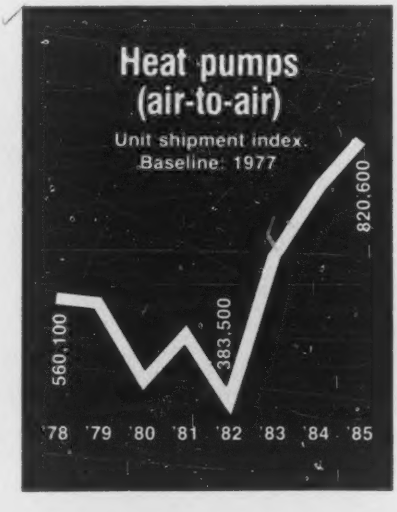
Our best judgement is that we, and apparently many others, have misread the impact of air-to-air heat pumps on the multifamily housing market. Government statistics, while quite specific about heat pump penetration in the single-family home segment, offer no heat pump information relating to multifamily units.

We had been assuming, up to this point at least, that the penetration of heat pumps in multifamily units was about the same as the 30% penetration in single-family units. It would appear now, however, that heat pumps are going into something like 40% of multifamily units. Government statistics tell us only that 68.7% of multifamily starts last year were electrically heated.

Based on this assumption, then, we can expect heat pumps to set yet another record in 1986. With an increase in single-family home starts, a modest decline in multifamily starts, and other smaller markets holding steady, it is not unreasonable to expect shipments this year to reach 840,000 units. That would be an increase of 2.4% over last year's performance.

A disappointment to some marketers of air-to-air heat pumps has been the sluggish development of the market for add-on heat pumps used in conjunction with new and existing gas, oil, and electric furnaces. The prime reason is that the steep increases in fuel prices that spawned the idea have moderated and, in the case of oil, dropped sharply. Too, most of those who could or would add a heating-only heat pump to an electric furnace-air conditioning combination already have done so.

Meanwhile, in the wings, the gas industry continues its development work on gas-fired heat pump prototypes and a consortium of Japanese companies is concentrating on gas engine-driven heat pump technology.



The air-to-air heat pump figures included in the unitary totals supplied by ARI do not include all heat pumps made in the U.S. To these should be added ptac's in heat pump (reverse cycle) configurations, water-source heat pumps (both earth-coupled and closed-loop), air-to-water domestic hot water heat pump water heaters, and room unit heat pumps.

Water-source units

Shipments of water-source heat pumps, which amounted to only about 40,000 units a decade ago, increased by 1% in 1985 to 135,000 units. The total for 1984, after a 46% increase in the previous year, was 133,600 units.

The flattening of the growth curve reflects, to some extent, some consolidation within the ground-coupled segment and a drop in the small office building and high-rise condominium markets where many of the closed-loop systems are used. Because of the commercial and high-rise market weakness, a decline of about 10% in 1986 to about 122,000 units would not be unexpected.

Water-source units have been used for many years on closed loops tied to a small boiler and cooling tower or evaporative condenser to maintain a loop temperature between 60° and 90°F. They are usually applied in high-rise apartments or condominiums and in small and medium-sized office buildings where diversity of load can be expected.

Others use water from a pond, a well, or the ocean at temperatures as low as 45°. But the fastest-growing segment of the market uses closed vertical or horizontal ground loops filled with a heat transfer fluid (usually water and propylene glycol) to provide comfort heating and cooling at high efficiencies.

These water-to-air and water-to-water applications do not have to depend upon the quantity or the quality of ground water and, because they can use vertical holes spaced relatively close together, they can be applied in urban areas. Equally important, these systems do not require a defrost cycle and can be sized for the full design heating load without the need for a

TURN TO PAGE 30

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back-up heat source.

It must also be said, however, that these systems have a comparatively high first cost and require specialized application knowledge not always found among local contractors.

Heat pump water heaters

Domestic hot water in U.S. homes traditionally has been heated in natural gas- and electric resistance-fired storage tanks. A few homes use LPG (liquefied petroleum gas) and oil burners to heat hot water and a few, particularly in the Northeast and Midwest, use a water jacket on gas- and oil-fired boilers.

Instantaneous hot water heaters of the type popular in Europe so far have made little impression on the North American market. Instead, increasing energy prices have motivated homeowners to add extra insulation to storage tanks, add solar assist, and to use desuperheaters in areas where the operating hours of air conditioners and heat pumps can justify the extra cost.

The air-to-water heat pump, with an installation cost more than twice that of an electric resistance water heater, entered the marketplace six years ago with the promise of 40% savings in operating costs. There were hopes that these units would capture a healthy chunk of the 7 million-unit water heater market — now evenly split between gas and electricity — but it hasn't happened.

Moderating energy price escalations and a public that seldom knows what portion of their electricity bill goes for water heating were the main causes. Contractors who were hesitant about cutting into potable water lines was another.

Rooftops

Driven by a relatively strong new home market and a trend in office buildings from downtown to suburbia, commercial rooftop shipments in 1985 increased by 5.3%. According to our calculations, the total shipped last year amounted to 142,250 units, up from 134,500 rooftops shipped in 1984.

The increase last year follows expansions of 27.3% in 1984 and 20% a year earlier as the economy moved out of the 1982 recession. Shopping center and retail store construction tends to follow closely behind the housing market, a factor that would appear to assure continued strength at least through 1986.

Too, there has been a growing trend to build low-rise office buildings in the suburbs, a trend that favors the commercial rooftop market. Although total construction in this market segment is slowing, improvements this year can be expected in the Northeast and in the South.

Not to be forgotten is the growing importance of the replacement market. Not only are the early rooftops of the 1960's and early 1970's inefficient by today's standards, many of them are worn out. We estimate that 45% of the commercial rooftops being shipped today are going into the replacement market. Many believe that replacements will account for more than 60% of total shipments by the end of the decade.

Commercial rooftops really represent a market application of several different products rather than a single product type that can be identified statistically.

For example, all-year units are identified both by ARI and the Bureau of the Census and clearly imply a heating capability. However, both single-package and split-system rooftops, although they may have been shipped (and counted) as cooling-only units, may have a modular heating section added in the field.

Too, heat pumps imply one and usually two methods of heating as well as a cooling capability. Another complicating factor is that small, all-year rooftops are applied in more residential than commercial situations.

The News bases its assessment of the commercial rooftop market on the known number of unitary shipments in 1985 and 1984 of 5.4 tons or more, and by past ARI ratios of system types by sizes and by residential and commercial application. Although not as up to date as we would like, the exercise produces totals within a few percentage points of the latest ARI figures by size of product.

By applying these ratios to ARI's 1984 and 1985 unitary shipment figures, we find there were 625,200 commercial units shipped in 1985, down 0.5% from the revised total of 628,600 units shipped in the previous year. We also found that, in 1985:

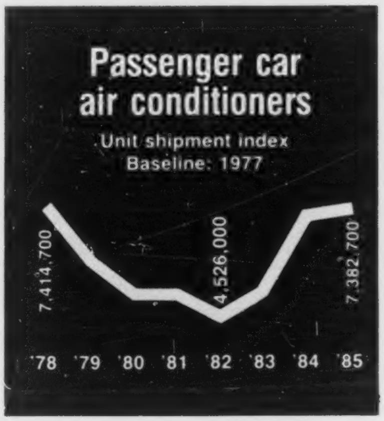
- 270,150 were split systems, of which 39,350 had capacities in excess of 5 tons.
- 171,500 were all-year single packages, of which 52,600 had capacities in excess of 5 tons.
- 105,000 were cooling-only air conditioners, of which 33,400 had capacities in excess of 5 tons.
- 500 were multizones, all of which had capacities in excess of 5 tons.
- 78,500 were heat pumps, of which 16,400 had capacities in excess of 5 tons.

Taken together, 142,250 were commercial rooftops with capacities in excess of 5 tons. It must also be noted that, just as there are some commercial rooftops with capacities of less than 5 tons, there also are residential units with capacities above that arbitrary dividing line. Separating the mix, however, is next to impossible.

Mobile air conditioning

According to Ward's Automotive Reports, there were 7,382,673 air conditioning units installed on U.S. domestic automobiles in the 1985 model year, up 2.3% from the 7,215,635 factory installations made in 1984.

The performance of factory air conditioning installations is in contrast to the performance of the domestic auto industry as a whole. Production declined marginally from 8,588,485 units in the 1984 model year to 8,472,599 units last year, a 1.35% drop.



The difference is accounted for by a shift in the penetration of air conditioning from 84% of all domestic autos produced in the 1984 model year to 87% of all cars produced in the U.S. in the last model year.

For cars made in the U.S., virtually 100% of luxury and full-size models are air conditioned at the factory. And, as can be seen from the penetration figures, most smaller cars also come equipped with comfort cooling because

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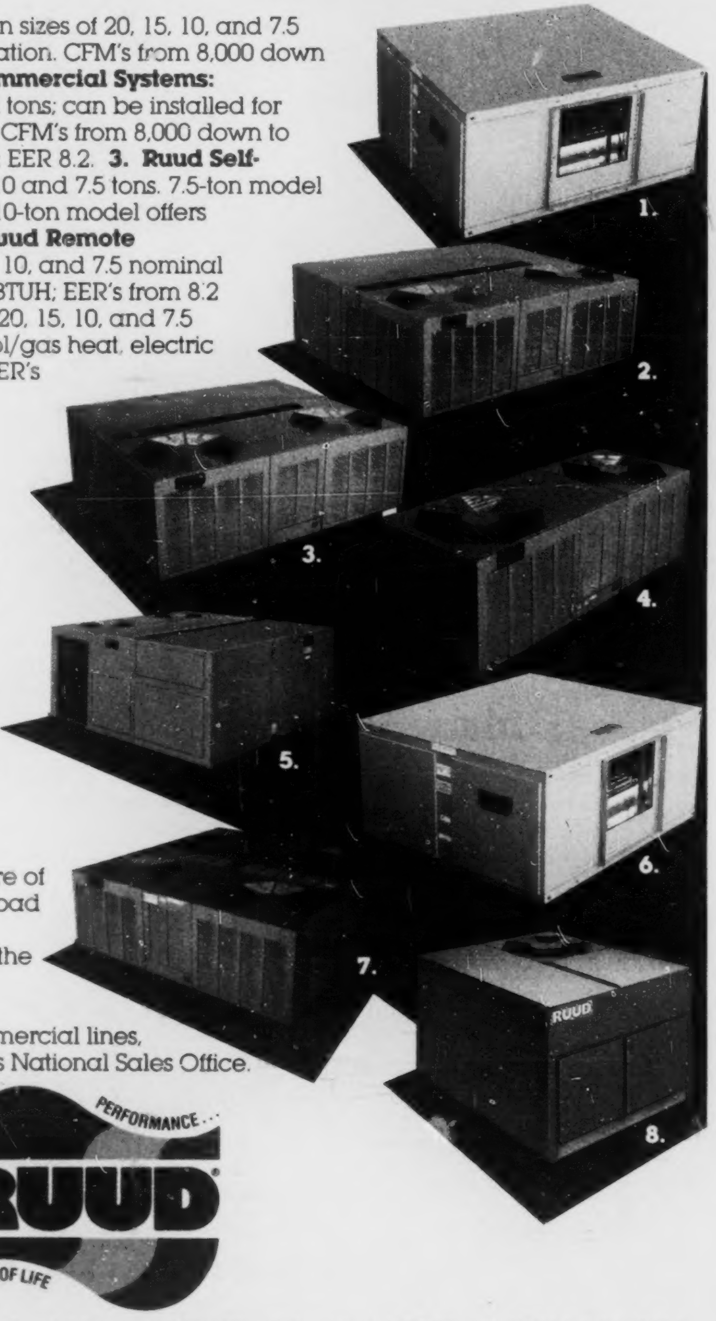

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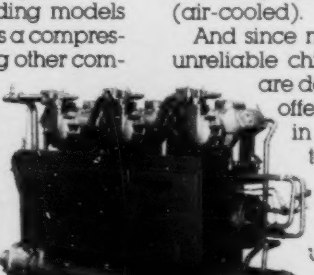

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FROM PAGE 30

of the easy availability of air conditioners in the smaller sizes.

Less than half of most subcompact models, however, are equipped with air conditioning at the factory. This is partially due to the fact that these are the lowest-priced models and air conditioning is the most expensive option. Engines, too, are smaller, an important consideration when air conditioning is coupled with an automatic transmission.

It might also be noted that 2,178,098 of the 3,555,691 light trucks produced in the U.S. in the 1985 model year were equipped with factory air conditioning. That's an increase of 17.6% over the 1,851,497 light trucks air conditioned in the 1984 model year.

Again, the penetration of air conditioning in light trucks has increased steadily from 54.9% in 1983, to 58.7% in 1984, and to 61.3% last year.

Although Ward's figures were not complete when The News went to press, it reported that 1,001,067 of the 1,772,201 cars imported into the U.S., for which figures are available, were air conditioned. The penetration rate for this group, which did not include several luxury models, was 56.5%.

Also incomplete, the reports available show that 96,925 of 672,698 light trucks imported into the U.S. last year were equipped with factory air conditioning. That's a penetration rate of 14.4%.

Although 1985 figures are not available, the Bureau of the Census reported that 10,169,789 open-type automotive air conditioning compressors were shipped in 1984, up 21.3% from the revised figure of 8,382,250 compressors shipped in the previous year.

The Census Bureau also reported that 1,948,655 mobile air conditioners for trucks, agricultural, and off-road construction vehicles were shipped in 1984, up 25.1% from the 1,557,060 units shipped in 1983. Similarly, the Bureau reported that 12,232,621 auto air conditioning systems were shipped in 1984, up 30.8% from the 9,267,612 total shipped in the previous year.

The Census Bureau also reported that 373,959 recreational vehicle air conditioners were shipped in 1984, the latest year for which figures are available, up 12% over the previous-year total of 333,802 units.

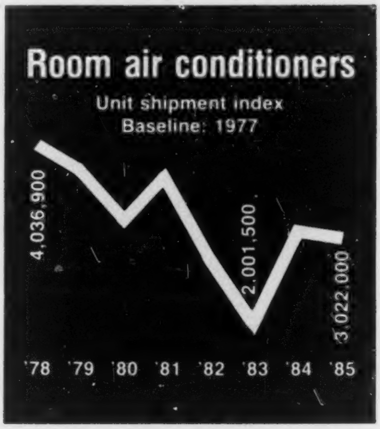
It's also interesting to note that, according to Department of Commerce figures, the U.S. imported 2,669,966 automotive air conditioning compressors in 1985, virtually all of them from Japan.

Aftermarket shipments of auto air conditioners have been in steady decline since 1978, primarily because of the increasing number of factory-installed units on imports, domestic autos, and off-highway vehicles. Its estimated that Japanese compressors, many of them built in U.S. plants, are being used in more than 80% of aftermarket auto air conditioners and an increasing number of cars built in this country.

Room air conditioners

Although room air conditioner shipments declined marginally last year, the performance was not too shabby given the competition both at home and abroad.

Shipments in 1985 totaled 3,021,900 units, down 2.6% from the 3,102,800-unit total recorded in the previous year. Both figures were far short of the more than 4 million units shipped in 1978, according to the Association of Home Appliance Manufacturers (AHAM).



It's unlikely that the experience of the 1970's, when more than 5 million units were shipped routinely, ever will return. Not only has central air conditioning become a standard feature in an increasing number of U.S. homes, but the Japanese succeeded the U.S. as the world's leading exporter of room units in 1981 and have added to that lead ever since.

Since 1981, in fact, the U.S. has become a net importer of room air conditioners. Its major markets abroad, including the Middle East and South America, have largely evaporated in the face of the hard dollar and stiff foreign competition. Even the softening of the dollar in relation to major currencies is not expected to effect a major improvement.

Exports of room air conditioners last year amounted to 77,181 units, up 19.7% over the 1984 total of 64,468 units, according to the Department of Commerce. That's only 2.55% of total production last year. For many years the U.S. habitually exported about 25% of production.

Imports of room air conditioners into the U.S., on the other hand, have increased rapidly. In 1985 the U.S. imported 259,200 room air conditioners, an 82% increase over the 141,731 room air conditioners imported in 1984.

Of the imports, 115,400 came from Japan, up 28.9% over the previous year; 52,500 from Brazil, up 648% over 1984 performance; 45,800 from Singapore; 30,850 from Canada; and 1,900 from Israel. In all, imports exceeded exports by 182,000 units.

Contrary to early expectations, high energy costs have not caused consumers in significant numbers to switch from central air conditioning to the more selective room unit approach. If anything, the reverse has been the case.

Nor has the heat pump phenomenon been evident among room units in the same way that heat pump growth has been noted in the unitary air conditioner and packaged terminal air conditioner product categories. It's estimated that no more than 5% of total U.S. room air conditioner production consists of reverse-cycle units.

AHAM predicts that room unit shipments will drop another 12% this year to 2,650,000 units and, in 1987, increase to 2,980,000 units. Although all predictions are chancy, those involving room units are especially so because they remain essentially an impulse purchase. A hotter than usual early summer could make these forecasts look very conservative. Cool weather, on the other hand, could make the decline more precipitous.

Chillers

After a decline that began in 1980, chiller shipments increased in 1985 for the second year in a row. Last year's total was 11,780 units, up 5% over the 11,210 chillers shipped in the previous year but still far behind the 14,500-chiller total recorded in 1980.

The 3,490 centrifugal chillers

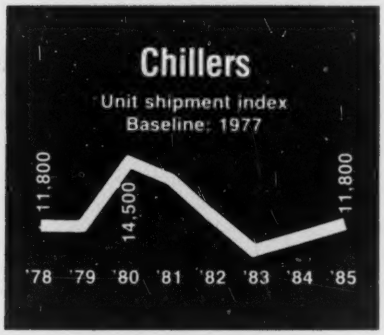
TURN TO NEXT PAGE

FROM PRECEDING PAGE

shipped in 1985 represent an 18% improvement over the previous year's total of 2,950 units. It must be noted that, since 1982, open-type centrifugal chillers have not been included in industry figures. The omission, which probably reduces the total by 400 to 500 units, protects individual manufacturer statistics.

In 1985 there were 8,160 reciprocating chillers shipped, a 0.7% increase over the 8,100 reciprocating chillers shipped in 1984. Shipments of absorption chillers, at 130 units last year, were down 18.75% from the 160 units shipped in the previous year.

Chiller shipments, until 1984, declined steadily since 1980 due in large measure to the hard dollar that has forced several of the largest U.S. manufacturers to build abroad most of the chillers destined for foreign markets.



Even though the dollar has declined by more than 25% in recent months in relation to the currencies of major trading nations, it's unlikely that those policies will change within the next 18 months, if then.

Other abnormalities also may have crept into the chiller statistics. We suspect that quite a number of screw compressors used for air conditioning may be included in both the centrifugal and reciprocating chiller totals, particularly in the case of Bureau of the Census figures.

For example, the Bureau of the Census reported 4,089 hermetic centrifugal chillers were shipped in 1983, the latest year for which complete figures are available. This total is 32% more than 3,100 units the industry claimed were shipped in that year. (Totals for 1984 were not published in order to protect individual manufacturer shipment figures.)

Similarly, the Census Bureau reported 13,763 reciprocating chiller packages were shipped in 1984, 30.6% more than the 10,533 units shipped in the previous year. The 1984 Census Bureau total, however, is 70% higher than the 8,100 units the industry claimed were shipped in 1984.

Screw compressors, for some reason, were grouped by the Census Bureau with automotive air conditioning compressors and no breakdown was available in the report covering 1984 shipments.

The Bureau also reported that 1,233 ammonia compressors were shipped in 1984, the latest year for which figures are available. That's an increase of 5% over the previous year's total of 1,173 units.

At the end of December, 1985, dollar bookings of centrifugals were up 40% over the same time a year previous and up 20% for the year compared to 1984. Similarly, dollar bookings of reciprocating chiller packages were up 22% at the end of December and up 8% for the year.

Even though we expect large commercial construction to drop somewhat in 1986, we think the orders already in hand will allow chiller shipments to increase this year by 5% to 12,400 units.

A breakdown by chiller type follows:

Year	Recip.	Cent.	Abs
1970	10,300	4,150	1,000
1971	10,000	4,000	900
1972	10,000	3,000	900
1973	10,400	4,100	800
1974	11,000	4,500	1,000
1975	8,250	4,950	700
1976	7,600	3,400	500
1977	8,900	3,000	450
1978	8,100	3,350	370
1979	8,100	3,350	280
1980	9,650	4,600	280
1981	9,250	4,300	240
1982	8,500	3,600	200
1983	7,500	3,100	140
1984	8,100	2,950	160
1985	8,160	3,490	130

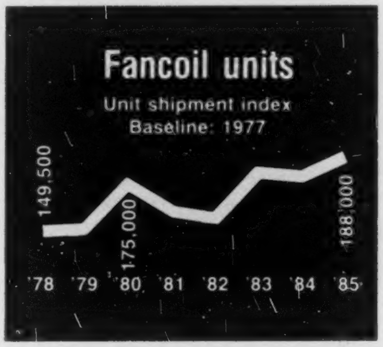
Evaporative condensers

Shipments of evaporative condensers for 1984, the latest year for which figures are available, amounted to 2,678 units, a 24.6% increase over the total of 2,149 units shipped in the previous year, according to the Census Bureau.

Fancoil units

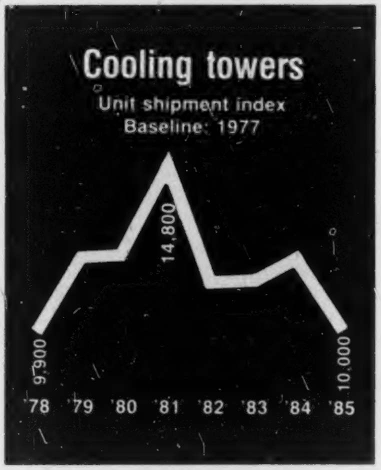
Domestic shipments of fancoil units in 1985 totaled 188,700 units, up 6% from the 178,000-unit total recorded in the previous year.

Bureau of the Census figures, which include exports as well as those units destined for U.S. home markets, show that 209,001 units were shipped in 1984, the latest year for which figures are available. That represents a 2.7% decline from the total of 214,799 units shipped in the previous year. Of those shipped in 1984, 47% were vertical, 44% were horizontal, and 9% were vertical stack-type units.



Cooling towers

The only figures available for cooling towers are those collected by the Bureau of the Census. In 1984, the latest year for which figures are available, the Bureau reported 10,853 cooling towers were shipped. This total is down 4.3% from the total of 11,344 cooling towers shipped in the previous year.



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REFRIGERATION

Unit shipments of commercial refrigeration equipment increased by 1% in 1985 over performance in the previous year, according to the Commercial Refrigerator Manufacturers Association (CRMA).

The trade association does not report numerical totals for either total shipments or for the various equipment categories. Based on the percentages supplied by CRMA plus prior-year data published by the Air-Conditioning and Refrigeration Institute (ARI) and the Bureau of the Census, The News estimates that shipments in 1984 totaled 93,400 units. The increase in 1985 would bring the new total to 94,300 units.

CRMA reported that shipments of standard temperature cases in 1985 increased by 3.3% over similar shipments in 1984. Shipments of reach-in cases last year increased by 1.4% and shipments of "other" cases increased by 28.3%.

Shipments of standard-temperature island units, a new category established in 1984, increased by 10.9% in 1985 over totals for the previous year. CRMA no longer provides figures on walk-in coolers.

Shipments of low-temperature cases increased by 1.4% last year over 1984 totals. For the same period, shipments of single-deck cases were down 22.1%, multidecks were down 0.6%, and enclosed low-temperature case shipments increased by 11.1%. Of the enclosed cases, 2-door unit shipments were up 75.9%, 3-door up 2.5%, 4-door up 10.1%, and 5-door cases were up 12.3% over the previous year's performance.

Shipments of island-type low-temperature display cases, which increased by 18.6% in 1984, showed a 2.9% decline a year later. Like standard-temperature islands, this is a new category established in 1984.

Another view

Every five years the Bureau of the Census publishes figures on commercial refrigeration equipment that includes much more than the equipment normally used in supermarkets. The latest report, issued in 1984, covers shipments in 1982 and compares them to shipments in 1977. Dollars are current for the year reported.

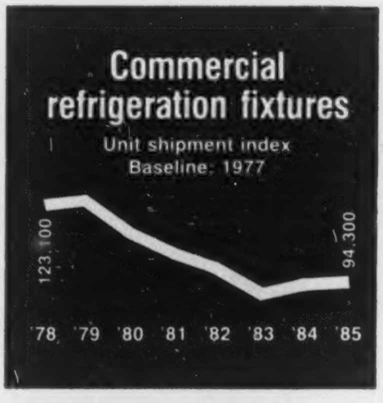
According to the report, the manufacture of commercial refrigeration equipment in 1982 totaled $1.064 billion, an increase of 40% from the $759.4 million total reported for 1977.

The Census Bureau reported that 68,800 sectional coolers, prefabricated walk-in and roll-in coolers, and combination cooler-display units were shipped in 1982. There was not a comparable shipment total for 1977 but the dollar value total increased by 39% from $158.6 million in 1977 to $220.5 million in 1982.

Normal-temperature reach-ins shipped in 1982 totaled 121,500 units, up 64.2% from the 74,000 units reported for 1977. The dollar value, however, increased by 97.4% from $68.2 million in 1977 to $134.6 million five years later.

The Bureau reported normal-temperature closed case shipments totaled 16,000 units in 1982, up 42.9% from the 11,200 total for 1977. Open single-level cases were down 5% from 26,000 in 1977 to 24,700 units in 1982. And open multilevels were almost even with a total of 31,700 units in 1977 and 31,300 units in 1982.

Low-temperature reach-ins shipped in 1982 totaled 43,500 units, according to the Bureau, up 45.5% from the 29,900 units shipped five years earlier. Ice cream dispensing-hardening cabinet shipments totaled 13,700 units in 1982, up 11.4% from the 12,300-unit total in 1977.


Commercial refrigeration fixtures

Unit shipment index
Baseline: 1977

Closed frozen food single-level cabinet shipments in 1982 totaled 13,200 units, down 59% from the 32,200-unit total five years earlier. On the other hand, closed frozen food multilevel cabinet shipments increased by 7.3% from 11,000 units in 1977 to 11,800 units in 1982. Shipments of frozen food cabinets other than reach-ins totaled 14,800 units in 1982, up 131% from the 6,400-unit total in 1977.

The value of other commercial refrigeration equipment, including dough retarders, egg refrigerators, environmental control equipment, laboratory, industrial, and unclassified products increased by 35.5% from $87 million in 1977 to $117.7 million in 1982.

Again we must emphasize that these Bureau of the Census figures include equipment that finds its way into convenience stores, restaurants, and industrial applications as well as supermarkets. Too, the Bureau reported that some of the quantities represent estimates with an error factor as high as 29%.

Supermarkets

In 1984 there were 30,175 supermarkets in the United States with annual sales of more than $2 million, according to Progressive Grocer. Of these, 12,675 (42%) were independent stores and 17,500 (58%) were chain operations. In addition, there were 42,950 convenience stores and another 82,875 stores that sell some food.

Of the supermarkets, 22,530 (74.7%) were conventional stores, 3,975 (13.2%) were superstores, 2,970 (9.8%) were economy stores, and 700 (2.3%) were combination stores. In share of the retail food market, the independent supermarkets captured 22.6%, the chains 49%, and the convenience stores 6.8%.

Importantly, Progressive Grocer reported that a net of 625 supermarkets

TURN TO PAGE 38

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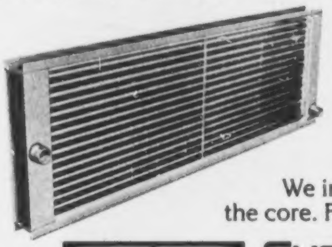

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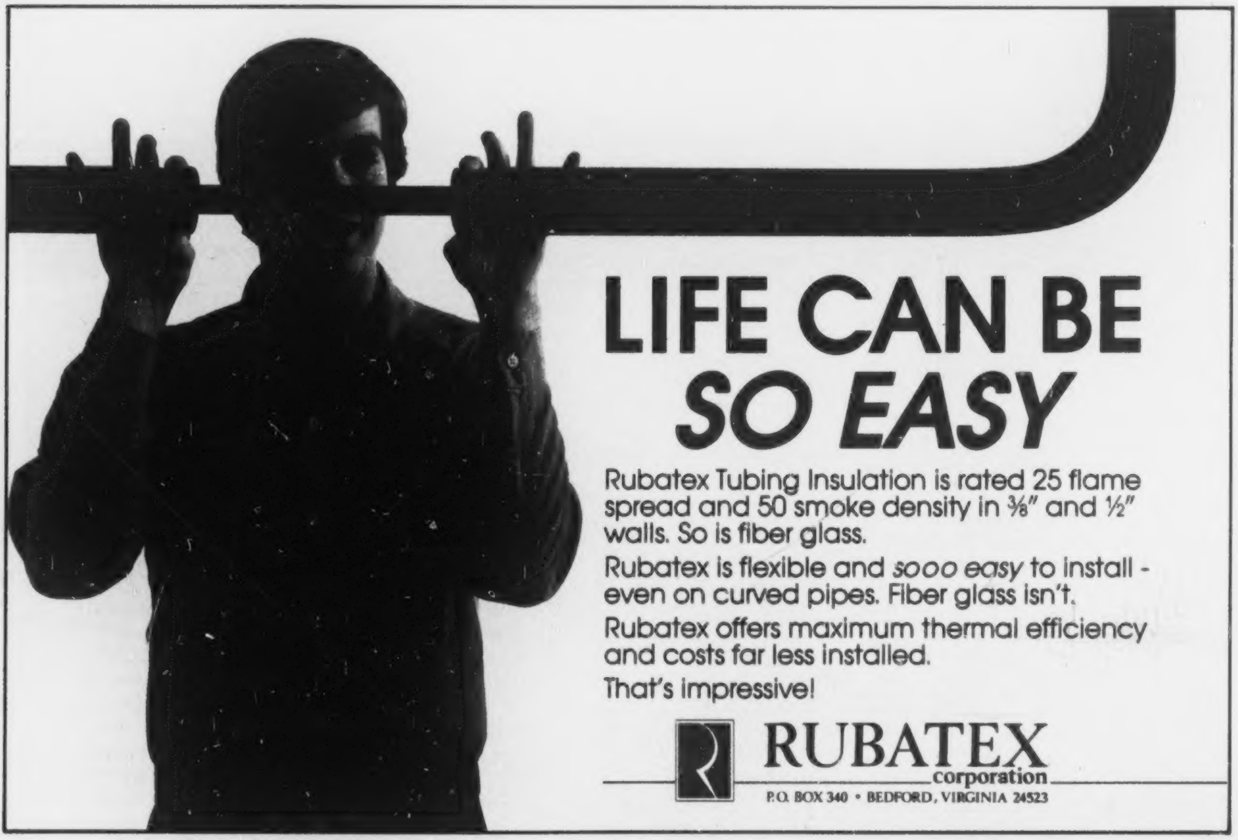

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REFRIGERATION

CONTINUED FROM 36

and 2,550 convenience stores were added in 1984, the latest year for which figures are available.

In a study conducted by Cornell University entitled "Operating Results of Food Chains," the net earnings after taxes for a typical supermarket was 9.87% of net worth or 0.94% of sales.

The 1984 study covered the operations of 5,232 supermarkets owned by 46 companies with aggregate sales of $46.7 billion. The average size of a store was 21,427 sq ft and average annual sales totaled $9.2 million. The average energy cost was 26 cents/sq ft for independents and 27 cents/sq ft for chains.

Energy control devices ranked second behind digital scales in equipment purchases of both independent supermarkets and chains, according to Progressive Grocer. Energy costs were the top concern at the store level but, with headquarters executives, they ranked second behind labor costs.

Refrigeration fixtures were involved in nearly 45% of all supermarket sales. The breakdown: dairy 9.8%; Deli 2.2%; frozen foods 6.2%; meat 18.1%; and produce 8.2%.

Among display fixtures, the top two items for independents were meat cases and glass-door frozen food cases. Chains ranked meat cases second and glass-door frozen food cases third. Independents bought energy-efficient glass-door frozen food cases at almost triple the rate of open-well (coffin) cases and at more than five times the rate of open multidecks.

Of those who have taken action to reduce energy costs, Frozen Food Age in 1985 reported that one word predominated: doors. It was the same for both new stores and retrofits. The adoption of energy management systems, heat reclaim, more efficient cases, and curtains were other means adopted.

Also in 1985, 80.8% of food retailers surveyed by the magazine reported that frozen food departments in stores which will be opened in the next two years will be larger than they are now — up from 73% in the 1984 survey.

Convenience stores

In a survey of convenience stores conducted by Convenience Store News, the operators of 7,145 stores reported that, in 1984, they had opened 195 new stores, acquired 506, sold 15, and closed 65. Of the 798 convenience stores operated by oil retailers, 20 stores were opened, four were acquired, four were sold, and 33 were closed.

Average sales per store for conventional convenience stores totaled $571,130 annually, up 4.7% from year-previous figures. New store building continued to decline. Acquisition was the primary method of expansion. Average annual merchandise sales for stores operated by oil retailers totaled $337,815.

The publication reported that 91% of conventional convenience stores are in the 1,800 to 3,000 sq ft category while convenience stores operated by oil retailers had only 20% of stores in that category. Another 77% of their stores were smaller.

Oil retailers saw fast food (57%) as the best opportunity to increase merchandise sales in 1984 followed by store refurbishing (43%). Conventional convenience stores saw refurbishing (81%) as the best opportunity followed by new stores (75%) and fast food (56%).

Refrigerators

Domestic refrigerator shipments totaled 6,080,500 units last year, up 1.4% from the 5,994,100 refrigerators shipped in 1984, according to the Association of Home Appliance Manufacturers (AHAM).

Continuing consumer confidence and a comparatively strong housing market should keep refrigerator sales even again in 1986.

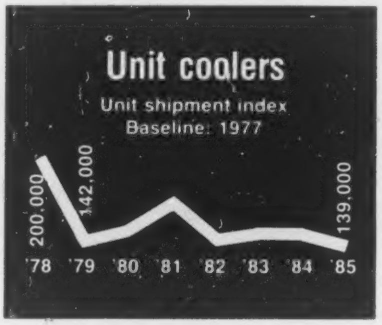
Shipments of home freezers in 1985 totaled 1,235,800 units, down 3.5% from the total of 1,280,700 home freezers shipped in the previous year. The 1985 breakdown shows that 634,200, or 51.3 %, were chest-type freezers and 601,600, or 48.7%, were upright freezers — a 1% shift in favor of uprights from the 1984 experience.

Unit coolers

Shipments of unit coolers, at 139,400 units in 1985, were down 4% from the total of 145,200 unit coolers shipped in the previous year.

It might be noted that the Bureau of the Census reported that 179,726 ceiling or wall-mounted unit coolers were shipped in 1984, the latest year for which figures are available, down 4.2% from the 187,612 unit coolers shipped in 1983. No figures were available for floor-mounted dry or spray-type unit coolers.

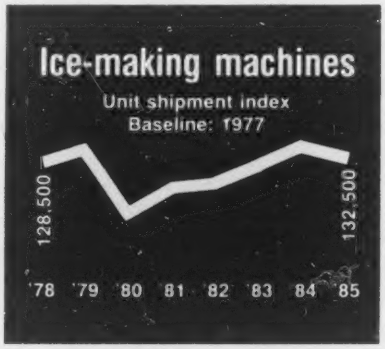
In this case, the industry figures do not include either exports or the production of some significant manufacturers.



Ice-makers

Shipments of ice-making equipment in 1985 totaled 132,500 units, down 2.7% from the previous-year total of 136,200 units. The News believes that 76% were cubers, 14% were flakers, and the remaining 10% were miscellaneous and combination units.

The Bureau of the Census reported that 218,281 ice-making machines were shipped in 1984, the latest year for which figures are available, up 31.2% from the total of 166,399 ice makers shipped in the previous year.



For 1984, a total of 181,197 units (83%) were cubers, 23,425 units (10.7%) were flakers, and 13,659 units (6.3%) were combination units.

Although there continues to be a disparity between the two sets of figures, it is much less than in the past. Most of the difference now is thought to be because industry figures include only U.S. domestic shipments and the Bureau's figures also include exports.

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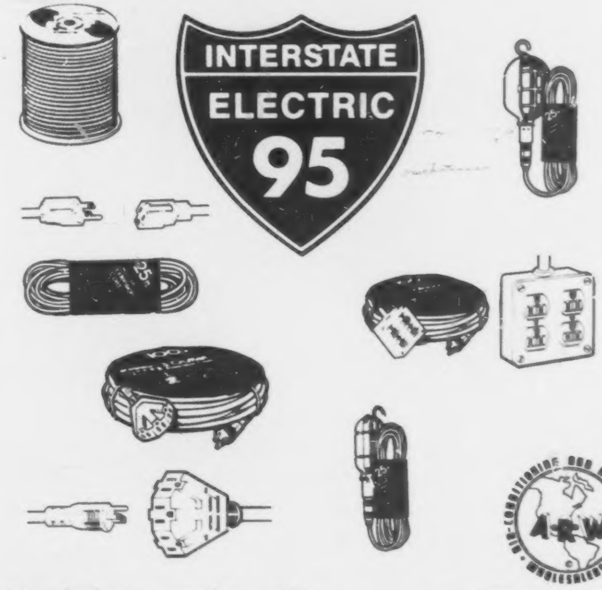

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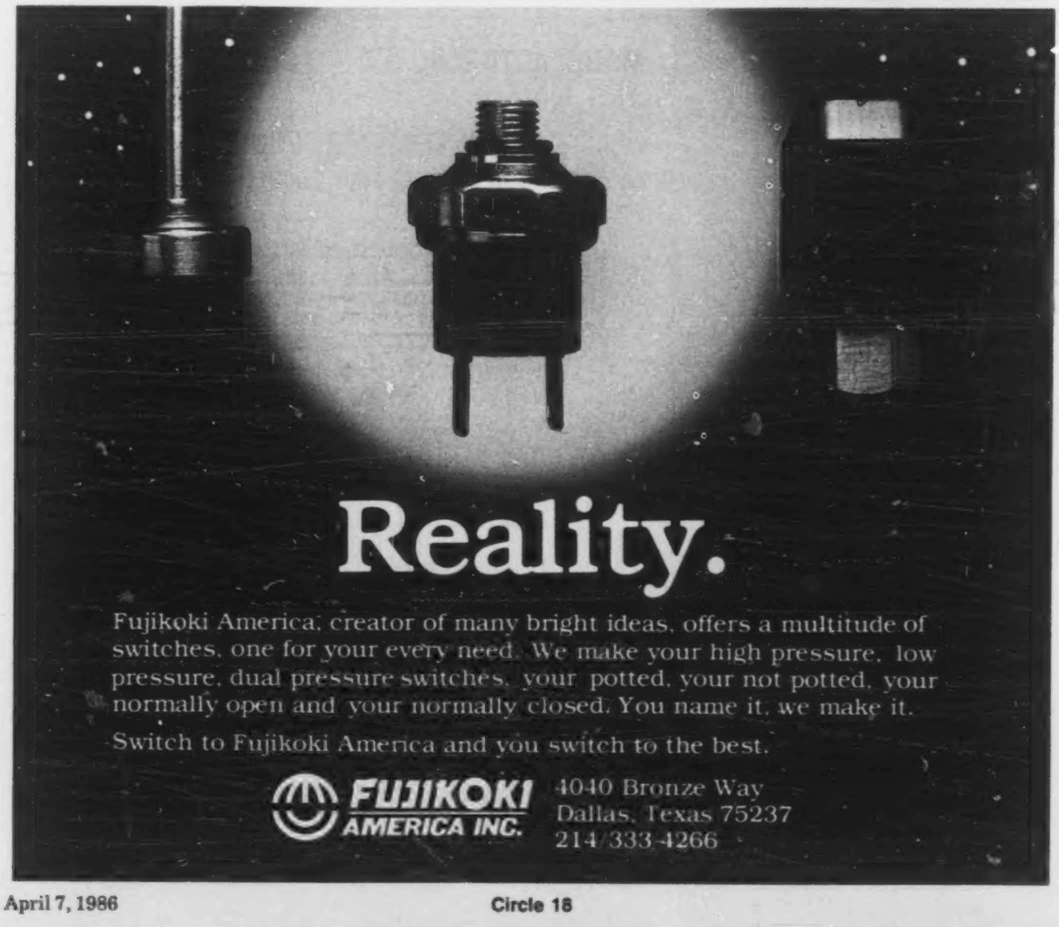

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HEATING

Residential boilers

Gas- and oil-fired boiler unit shipments showed healthy increases again in 1985 thanks to continued strength in the replacement market and slight penetration gains in new home construction. Total shipments last year amounted to 305,224 units, up 10.1% over the 277,216-unit total recorded in the previous year, according to The Hydronics Institute (HI).

Shipments of **cast iron boilers,** at 236,594 units in 1985, were up 10.8% from the 237,860 units shipped in 1984. Shipments of **steel boilers** increased by 5.8% from 39,356 units in 1984 to 41,630 units last year.

The surge of gas-fired boiler shipments at the turn of the decade is long over. It was brought on by high oil prices and the sudden availability of natural gas, which had been curtailed in many parts of the country. Since then, oil prices have peaked and dropped back more than 25% while gas prices continued to escalate until 1984 when, in some area, small reductions were reported.

The gas share of the cast iron boiler market, which soared to 85% in 1980, settled back to a more normal 66.9% in 1984 and 64.8% last year. It had dropped to 50% in 1977, the last year of widespread gas curtailments.

It might also be noted that only 2.4% of steel boilers shipped in each of the last two years were gas-fired. Of the remainder shipped last year, 86.8% were oil-fired and 10.8% were shipped bare (without burners).

Oil's share of the cast iron boiler market in 1985 was 35.2%, up slightly from the 33.1% share the previous year and more than double the 15% share held by oil in 1980. The oil share in 1977 was 49.5%. HI reported no shipments of cast iron boilers fired by solid fuels in 1985.

The share of cast iron hot water boilers, at 79.9% in 1985, was up just slightly from 77.8% in the previous year. Conversely, cast iron steam boilers accounted for 20.1% of shipments last year, down from 22.2% in 1984.

Radiation shipments in 1985, according to HI, were: convectors 1,689,191 sq ft EDR (equivalent direct radiation), down 53.8% from the 1984 total of 2,598,330 sq ft EDR; baseboard 13,513,746 lineal ft, up 12.6% from the 12,000,375 lineal ft total in 1984; commercial finned tube 7,286,380 sq ft EDR, down 8.9% from the total of 8,000,795 sq ft EDR recorded a year earlier; and finned tube 1,470,082 lineal ft.

Shipments of radiation products are far below those of only a few years ago. In 1979, for example, total radiation shipments amounted to 57.8 million sq ft EDR. The prime reason for the drop is the strong boiler replacement market — about 85% of the total — where radiation already is in place.

Although the recovery of the new home market has not helped hydronics greatly, the past year saw an increase in both the number of boilers going into new homes and a modest increase in market share. Of the new homes completed in 1985, hydronics' share amounted to 4.3%. That's a 0.3% increase from the previous year.

This independence from the often volatile new home market is both a curse and a blessing. It's a curse because increased market share is hard

1985 cast iron boiler shipments by thermal capacity

Gross output, Btu/h	Steam	Water	Total
Less than 50,000	1,038	9,627	10,665
50,000 to 74,999	1,020	24,020	25,040
75,000 to 99,999	8,535	43,768	52,303
100,000 to 124,999	15,092	55,193	70,285
125,000 to 149,999	6,165	30,767	36,932
150,000 to 199,999	9,574	23,186	32,760
200,000 to 249,999	4,690	10,909	15,599
250,000 to 449,999	4,189	6,987	11,176
450,000 to 949,999	2,282	2,124	4,406
950,000 to 1,549,999	1,183	955	2,138
1,550,000 and over	1,355	935	2,290
Total	55,123	208,471	263,594

1985 cast iron boiler shipments by fuel

Gross output, Btu/h	Gas-fired	Oil-fired	Total
Less than 50,000	10,638	27	10,665
50,000 to 74,999	24,454	586	25,040
75,000 to 99,999	46,227	6,076	52,303
100,000 to 124,999	40,816	29,469	70,285
125,000 to 149,999	16,709	20,223	36,932
150,000 to 199,999	13,046	19,714	32,760
200,000 to 249,999	9,555	6,044	15,599
250,000 to 449,999	6,313	4,863	11,176
450,000 to 949,999	1,961	2,447	4,406
950,000 to 1,549,999	753	1,383	2,138
1,550,000 and over	388	1,902	2,290
Total	170,860	92,734	263,594

TURN TO NEXT PAGE

1985 steel boiler shipments

Gross output, Btu/h	Oil-fired	Gas-fired	Bare	Total
Up to 100,000	6,567	523	890	8,259
101,000 to 125,000	17,110	198	1,720	18,999
126,000 to 150,000	6,822	46	789	7,469
151,000 to 175,000	3,336	25	677	4,202
176,000 to 200,000	890	13	126	1,015
201,000 to 300,000	916	24	46	981
301,000 to 500,000	286	22	4	312
501,000 to 750,000	145	82	12	235
751,000 to 1,000,000	41	35	6	82
1,001,000 to 1,400,000	17	21	3	38
1,401,000 to 2,350,000	12	21	5	38
2,351,000 to 3,350,000	—	—	—	—
Total	36,142	1,010	4,478	41,630

FROM PRECEDING PAGE

to come by. But it's a blessing because the stability of the service and replacement market tends to soften any recession blows.

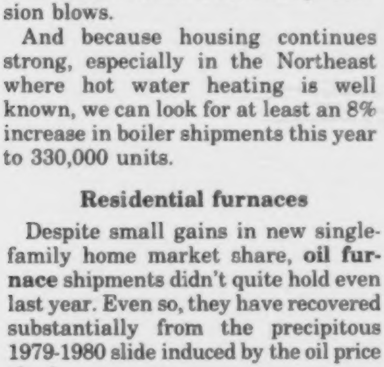
And because housing continues strong, especially in the Northeast where hot water heating is well known, we can look for at least an 8% increase in boiler shipments this year to 330,000 units.

Residential furnaces

Despite small gains in new single-family home market share, **oil furnace** shipments didn't quite hold even last year. Even so, they have recovered substantially from the precipitous 1979-1980 slide induced by the oil price shock.

Oil furnace shipments in 1985 totaled 147,260 units, down 0.5% from the year-previous total of 148,025 units, according to the Gas Appliance Manufacturers Association (GAMA). The total in 1980 was 63,400 units.

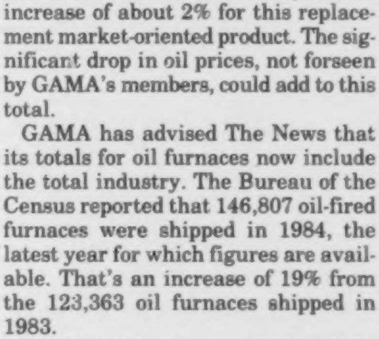
In November, 1985, GAMA's members forecast that oil furnace shipments this year would slip by 4.4% to 140,800 units. With the benefit of four months into the new market, we would disagree. Look for oil furnace shipments to reach 150,000 this year, an increase of about 2% for this replacement market-oriented product. The significant drop in oil prices, not forseen by GAMA's members, could add to this total.



GAMA has advised The News that its totals for oil furnaces now include the total industry. The Bureau of the Census reported that 146,807 oil-fired furnaces were shipped in 1984, the latest year for which figures are available. That's an increase of 19% from the 123,363 oil furnaces shipped in 1983.

A slight drop in new single-family home market share and a less-than-anticipated increase in the replacement market combined to produce a 1.5% drop in **gas furnace shipments** in 1985 to 1,822,295 units, down from 1,849,200 units in the previous year.

It must be remembered that, in the last two years, gas furnace shipments have almost reached the 1979 level after sinking to 1.15 million units in 1982. We tend to agree with GAMA's members that gas furnace shipments this year will hold about even.



For the record, the Bureau of the Census reported that, in 1984, a total of 1,840,625 gas furnaces were shipped, up 10.6% from the 1,664,045 gas furnaces shipped in the previous year.

Gas-fired unit heater shipments continue to show strength after several years of decline. Shipments in 1985 totaled 184,188 units, up 11.8% from the total of 164,743 units shipped in the previous year. Of the total, 93.7% were propeller fan types and 6.3% were blower types. This market should hold steady this year.

It should be noted that the Bureau of the Census reported 1984 gas-fired unit heater shipments of 258,363 units, up 16% from the 222,661 units shipped in the previous year. Obviously the government figures include the output of manufacturers who do not participate in the industry program.

Gas-fired duct furnace shipments increased by 5.9% in 1985 to 20,870 units. The total for 1984 was 19,703 units. This product category should hold steady in 1986.

Gas-fired residential wall furance shipments in 1985 totaled 206,430 units, up 15.1% from the 179,310 unit total for the previous year. Of the total, 67.2% were vented wall furnaces and the remaining 32.8% were direct-vent systems.

The latest Bureau of the Census figures, which also include commercial and industrial wall furnaces, show a total of 342,599 wall furnaces were shipped in 1984, up 9.4% from the total of 310,376 units shipped in the previous year.

Shipments of **recreational vehicle heating systems** in 1985 totaled 201,702 units, up 5.9% from the year-previous 190,470-unit total. GAMA reports these figures, which include both direct-vent wall and direct-vent central furnaces, are not expended to industry.

Shipments of **gas-fired floor furnaces** totaled 22,085 units in 1985, up 6.1% over the 20,825-unit total for 1984. The Bureau of the Census reported 25,211 gas-fired floor furnaces were shipped in 1984, the latest year for which figures are available, up 4.6% over the 24,092 floor furnaces shipped in the previous year.

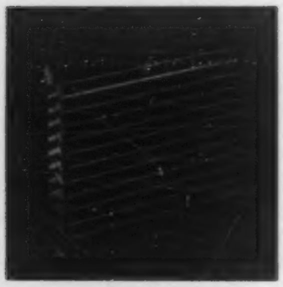
Some perspective

Although it will be covered in more

TURN TO PAGE 45

Furnace Designers:

Get 93-96% efficiency with this new concept...



In this new concept, *compact high efficiency furnace* design, a gas or oil burner fires into a cylinder. The hot flue gases are pulled through a combustion chamber which consists of a cylinder and a vertical box, through the heat exchanger, and out the plastic flue pipe. If oil is used, a slotted, insulated sleeve inserted in the cylinder, is recommended.

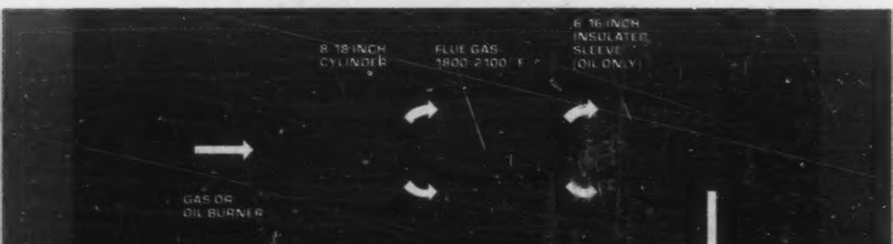
With the return air passing over the heat exchanger and combustion chamber, the temperature of the flue gas will be approximately 700° F when entering the heat exchanger and approximately 100° F when leaving the heat exchanger. This results in a 93-96% furnace efficiency.

Design Advantages:

- **Compactness: furnace height can be decreased by 10 to 15 inches.**
- **Components: same components can be used for either gas or oil furnace, except for burner and insulated sleeve.**
- **Cost: cost-effective compared to present designs.**
- **Efficiency: 93-96% furnace efficiency possible with this design. 75-80% furnace efficiency possible in same furnace with smaller heat exchanger.**
- **Design Options: same components can be used to design either vertical flow or horizontal furnaces.**

For assistance in designing heat exchangers for this application, contact Sundstrand Heat Transfer, 415 East Prairie Ronde Street, Dowagiac, Michigan 49047 U.S.A. 616/782-2141.

IN LESS SPACE!


8-18 INCH CYLINDER
FLUE GAS 1800-2100° F
6-16 INCH INSULATED SLEEVE (OIL ONLY)
GAS OR OIL BURNER
FLUE GAS 90-110° F
BLOWER
DRAIN
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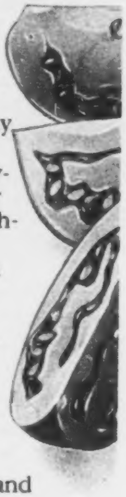


There is evidence that diet and cancer are related. Some foods may promote cancer, while others may protect you from it.

Foods related to lowering the risk of cancer of the larynx and esophagus all have high amounts of carotene, a form of Vitamin A which is in cantaloupes, peaches, broccoli, spinach, all dark green leafy vegetables, sweet potatoes, carrots, pumpkin, winter squash, and tomatoes, citrus fruits and brussels sprouts.

Foods that may help reduce the risk of gastrointestinal and respiratory tract cancer are cabbage, broccoli, brussels sprouts, kohlrabi, cauliflower.

Fruits, vegetables and whole-grain cereals such as oatmeal, bran and wheat may help lower the risk of colorectal cancer.

Foods high in fats, salt- or nitrite-cured foods such as ham, and fish and types of sausages smoked by traditional methods should be eaten in moderation.

Be moderate in consumption of alcohol also.

A good rule of thumb is cut down on fat and don't be fat.

Weight reduction may lower cancer risk. Our 12-year study of nearly a million Americans uncovered high cancer risks particularly among people 40% or more overweight.

Now, more than ever, we know you can cook up your own defense against cancer. So eat healthy and be healthy.

No one faces cancer alone.

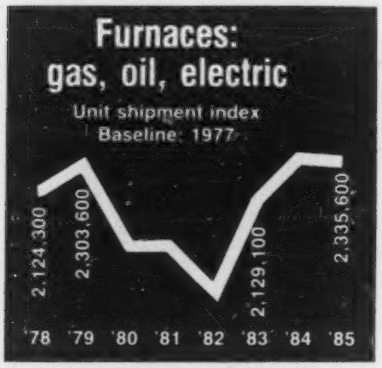
AMERICAN CANCER SOCIETY®

FROM PAGE 42

detail in "Comfort in construction," we should point out here that the volatility of fuel prices that has been a characteristic of the furnace market for several years continues unabated.

When the second major escalation in world oil prices impacted the U.S. in 1978, along with the sudden availability of natural gas after nearly a decade of curtailments, there was a wave of conversions to natural gas from oil and from electricity dependent on oil for its generation. The decontrol of oil prices in 1981 added fuel to the conversion fire.

This wave of conversions subsided in the early 1980's, a victim of the recession and a rising tide of natural gas price increases that ranged as high as 50% a year in the wake of increases in the controlled price of interstate natural gas.



Early in 1983, however, the price of natural gas edged past the price of residual fuel oil on a Btu-equivalent basis in many sections of the country. Major industrial users, who almost always can fire boilers with at least two fuels, began to switch from natural gas to heavy oil. For the natural gas industry, which sells about 60% of its gas to this class of user, the price ceiling had been reached.

We must hasten to point out, however, that this price ceiling applies to the industrial market. Increases in the price of gas to the residential and commercial markets still escalated — but not at the steep rate that was the case earlier in the decade. In fact, in late 1985 and early 1986 several gas utilities announced modest price reductions.

Natural gas supplies would appear to be more than adequate for the near term. The latest round of gas price decontrol passed almost unnoticed at the beginning of 1985 and, in fact, the gas industry's primary concern appeared to be how long the oversupply "bubble" would last.

The question is especially important because, early in 1986, the world oil price dropped to less than $15 a barrel, or half of what it had been a year earlier. This development, which could last through the end of this decade, again will shake up the cost relationships of all fuels.

The initial impact of the drop in oil prices, of course, will come in the industrial and electric utility markets where major users will make the shift to oil wherever possible unless the gas industry cuts its price. This could mean a tremendous oversupply for residential and commercial users but whether this condition translates into significant price reductions remains to be seen.

For those utilities that use oil to generate electricity, price reductions modified by overhead inflation can be expected. This is good news for heat pump proponents. Oil furnaces and boilers can be expected to increase — but not at a rate in keeping with the price reduction. The reason is quite simple. Because of limits in distribution, the fuel oil market is largely limited to the Northeast and the Midwest.

Additionally, we must also consider the momentum of the public's move to high-efficiency furnaces and boilers. Will the downward shifts in fuel prices blunt this phenomenon, now in its fourth year?

Although this subject, too, is dealt with more fully in "Comfort in construction," we feel that the rate of increase in high efficiency units will slow. In fact, there are signs that it had already begun to flatten in 1985.

Gas furnaces with an AFUE (annual fuel utilization efficiency) of 80% or more accounted for 15.4% of shipments in 1983. In 1984 it was 31% and, last year, 31.3%. Meanwhile, those gas furnaces with AFUE's of 71% or less decreased only from 63.9% of shipments in 1984 to 58.4% last year. The story for oil furnaces was much the same.

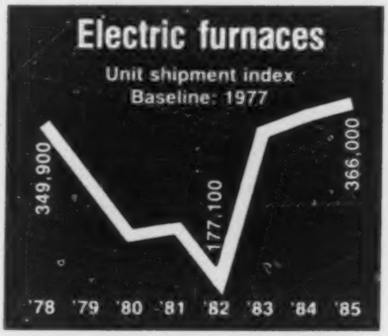
Electric furnace shipments, which tend to follow new home construction closely, totaled 366,020 units in 1985, up 3.3% over the 354,435 units shipped in the previous year. The increase from 1982 to 1983 was 92% and reflected a 60% increase in housing starts. Last year housing starts declined only marginally.

The primary role of the electric furnace is to serve as a back-up heat source for air-to-air heat pumps and as the sole heat source for some homes, mostly in the South where the heating season is relatively short.

GAMA's members expect electric furnace shipments to hold even in 1986. We think that's about right, although they could edge ahead by about 5% to 385,000 units.

Total **gas, oil, and electric furnace shipments** in 1985 amounted to 2,335,575 units, down 0.7% from the previous year's total of 2,351,600 units.

We think that the perception of stable or lower fuel prices in the near term, together with a relatively flat housing market, will combine to keep furnace shipments flat in 1986. Counterbalanced, too, will be increased home buying activity spawned by the lowest interest rates in many years.



In addition to the furnaces already covered, the Bureau of the Census reported there were 3,104 **gravity warm air furnaces** shipped in 1984, the latest year for which figures are available. That represents a decline of 20.1% from the 1983 total of 3,887 units. **Forced-air furnaces fired by solid fuels** (coal, coke, and wood) shipped in 1984 totaled 7,721 units, down 5% from the 8,128 units shipped in the previous year.

Similarly, the Census Bureau reported shipments of **electric unit heaters** in 1984 totaled 42,887 units, up 12.1% from the 38,240 units shipped in 1983. **Electric infrared heater** shipments in 1984 totaled 20,836 units, an increase of 16.9% over the 17,818 units shipped in 1983.

Shipments of **electric duct furnaces,** at 87,445 units in 1984, were up 6.3% from the year-previous total of 82,290 units. Shipments of **electric baseboard,** except glass panel types,

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FROM PRECEDING PAGE

in 1984 totaled 2,375,634 units, an increase of 14.5% over the 2,075,113 units shipped in the previous year. Shipments of **electric air space heaters,** other than baseboard, in 1984 totaled 1,414,033 units, an increase of 3.6% over the 1,364,290 air space heaters shipped in 1983.

Oil burners

Oil burner installations in 1985 totaled 536,000 units, up 5% over the 510,000 oil burners installed in 1984, according to Fuel Oil/Oil Heat and Solar Systems magazine.

Of these, 61,000 were installed in new single-family homes, up 6.3% from the 57,369 oil-fired systems installed in new homes in the previous year. New home installations totaled 85,000 in 1979.

The potential for oil-fired systems is limited, in large measure, by the regionality of its distribution system. Although oil had a 16.8% share of the new single-family home market in the Northeast last year, the Northeast accounted for only 15.4% of the new homes built. Oil captured less than 1% of the new single family homes built in the Midwest and practically zero in the South and West. The penetration nationally was 2.6% for single-family homes.

In the multifamily market, oil captured 3.1% of the Northeast market but only 0.1% of the multifamily homes nationally. The penetration in the Midwest, South, and West was not high enough to record.

There were 258,000 **replacement oil burners** shipped in 1985, down 41.9% from the 443,690 replacement burners shipped in the previous year. The magazine estimated that more than 80% of these were retention-head or other high-efficiency burners that were used to replace less efficient burners on a voluntary (simply to save fuel) or involuntary (breakdown) basis.

Conversions to oil from other fuels in 1985 were estimated at 30,000, up 233% from the estimated 9,000 conversions in 1984. Most of these conversions were from electricity although, in regions where natural gas is imported, some have converted to oil. Conversions from oil to natural gas, which approached 300,000 in 1980, are not considered a significant factor today.

The Bureau of the Census reports that 27,370 **commercial and industrial oil burner units** were shipped in 1984, the latest year for which figures are available, up 12.6% from the total of 24,297 units shipped in 1983.

Replacement oil burners for commercial and industrial applications in 1984 totaled 23,903 units, up 17.5% from the total of 20,338 units shipped in 1983. Again there was no breakdown of the low- and high-pressure atomizing types. In previous years, they have been almost evenly split.

The Census Bureau also reported 3,590 **oil-fired floor and wall furnaces** were shipped in 1984, up 19.6% from the total of 3,001 furnaces of this type shipped in the previous year.

The Bureau reported that, in 1984, a total of 451,943 **replacement oil burners for residential applications** were shipped, up 10.4% from the total of 409,244 residential replacements shipped in 1983.

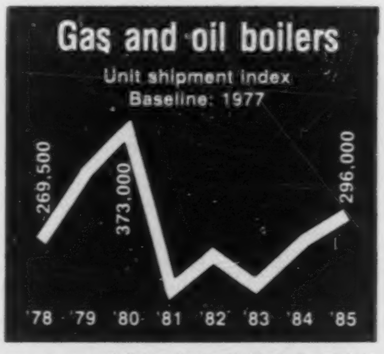
Commercial boilers

The American Boiler Manufacturers Association (ABMA) forecast that the market for commercial and industrial firetube boilers in 1986 will total 22.7 million equivalent pounds of steam per hour, or 680,000 hp.

That's an increase of 25.7% over 1985 shipments that totaled 18.1 million equivalent pounds of steam per hour, or 541,000 hp. The 1984 total for this category was 513,000 hp.

Other heating equipment

In order to provide some perspective on the total comfort space heating scene we might point out that, in 1984, the latest year for which figures are available, the Bureau of the Census reported shipments of 1,199,721 **domestic heating stoves,** down 4% from the previous year.



Of these:

- 174,049 were gas-fired, down 1.3% from 176,266 units shipped in 1983. This category includes radiant units as well as vented and unvented circulating types.
- 286,976 used other fuels — including kerosene, gasoline, fuel oil, and coal. This category was up 9.4% from the total of 262,283 units shipped in 1983.
- The total for wood stoves, at 738,696 units in 1984, was down 8.9% from 811,135 units in the previous year. This included 86,786 freestanding fireplaces, down 20.2% from 108,721 units in 1983; and 231,826 wood stoves, down 4.7% from 243,193 wood stoves shipped in 1983. Of the wood stoves shipped in 1983, 40.2% were circulating types, 28.6% were radiant heat types, and the remaining 31.2% were other types.
- Shipments of zero-clearance fireplaces in 1984 totaled 231,829 units, down 8.2% from a total of 252,337 units in the previous year. The 1982 total was 128,621 units.
- Fireplace insert shipments in 1984, at 132,789 units, declined by 20.9% from 167,840 units in 1983.

Solar

The Bureau of the Census reported that shipments of solar collectors totaled 172,534 units in 1984, the latest year for which figures are available, down 1.5% from the revised total of 175,080 solar collectors shipped in the previous year.

Of the total shipped in 1984, **low-temperature collectors** designed to operate at temperatures below 110°F accounted for 37.4%, or 64,530 units. The portion, slightly below that of the previous year, was down 7.7% from the 69,933 units shipped in 1983.

Of the 108,004 **medium-temperature collectors** shipped in 1984, up 2.7% from the 105,147 medium-temperature collectors shipped in the previous year, 11.3% (12,254 units) were air collectors and 88.7% (108,004 units) were liquid collectors. These percentages were roughly comparable to those of previous years.

No figures were available for high-temperature collectors operating at temperatures above 180°F, including concentrating and evacuated-tube collectors, because they might disclose the shipments of individual companies.

The solar collector record, in units:

1978			170,611
1979	226,659	up	33%
1980	303,102	up	34%
1981	254,768	down	16%
1982	201,217	down	21%
1983	175,080	down	13%
1984	172,534	down	1.5%

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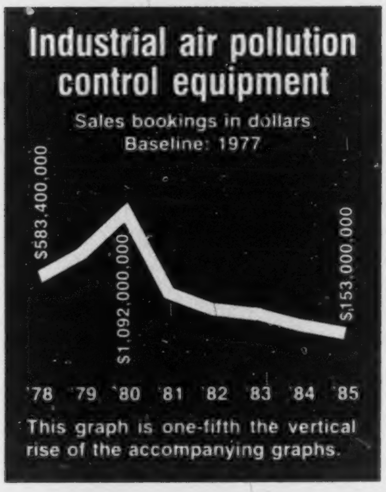


Industrial air pollution control equipment

Sales bookings in dollars
Baseline: 1977

This graph is one-fifth the vertical rise of the accompanying graphs.

Sales bookings for industrial air pollution control equipment, which peaked at just over $1 billion in 1979, continue to spiral downward precipitously, according to the Industrial Gas Cleaning Institute (IGCI).

Total new orders for 1985 amounted to $153 million, down 23.8% from the $200.7 million total new orders reported for the previous year.

The booking value for electrostatic precipitators, at $37 million in 1985, represented a 47.6% decrease from the $70.6 million total for 1984.

Fabric filter bookings, at $80 million last year, were 42.8% ahead of the $56 million pace set a year earlier.

Flue gas desulphurization equipment bookings, at $8.9 million in 1985, were down 76% from the total of $37.2 million in 1984. The level of bookings in 1979 for this category was $404 million and, in 1983, bookings totaled $191.7 million.

The value of gaseous emission controls bookings in 1985 totaled $4.8 million, down 31.4% from the year-previous total of $7 million.

Mechanical collector booking values, at $9.6 million in 1985, were down 23.2% from the $12.5 million total in 1984.

Wet scrubber bookings, at $12.7 million last year, represented a 25.3% decrease from the 1984 total of $17 million, according to IGCI.

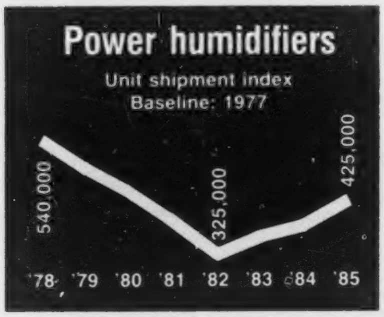
The institute statistics cover new orders for installations in the U.S. and Canada. All orders include bare flange-to-flange hardware with the exception of flue gas desulphurization equipment, which includes the total contract value.

Power humidifiers

Power humidifier shipments, which ranged around the half-million mark in the mid-1970's, have declined for both economic and technological reasons in recent years. But they are making a comeback.

We feel that power humidifier shipments increased by 13% last year to 425,000 units, up from 375,000 units in 1984. Shipments in 1986 should hold even or, possibly, edge ahead by 5% or so.

Although approximately nine of ten power humidifiers are installed in existing homes and only about 10% go into new homes, they often are installed soon after a new or existing home is purchased by people who, for reasons of health or comfort, feel they want the benefits of humidification.



Power humidifiers

Unit shipment index
Baseline: 1977

Power humidifier shipments suffered through the recession when the sales of both new and existing homes were at a low ebb. The growing number of tightly insulated homes is likely to limit the humidifier's potential in future years. Because infiltration rates are so low in these homes, air-to-air heat exchangers or dehumidifiers often are needed to get rid of humidity build-up rather than add to it.

The growth of humidifier shipments over the past three years is attributable, in large measure, to the recovery of the housing markets in both the Midwest and Northeast. An Energy Information Administration study published in 1984 indicated that, of the 11.3 million humidifiers in U.S. homes, 6.3 million were in the Midwest and 2.5 million were in the Northeast.

For the record, the Bureau of the Census reported that 427,198 central and self-contained humidifiers were shipped in 1984, the latest year for which figures are available. That's a 31.5% increase from the 324,948 units the Bureau said were shipped in the previous year. Note, however, that these figures contain both central power humidifiers and console types.

Fans

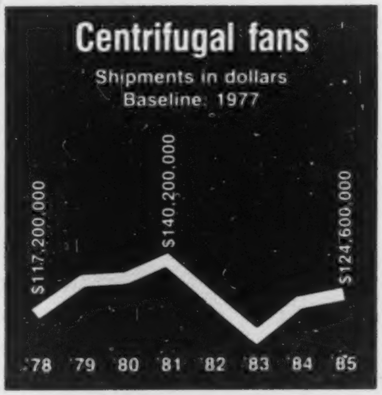
Both the Air Movement Division and the Air Control Division of the Air Movement and Control Association (AMCA) reported improved business conditions last year, although there was a slight decrease in the case of axial and propeller fans.

Shipments of centrifugal fans, at $124,554,256 in 1985, showed a 2% increase from the total of $121,527,387 in the previous year.

Industrial axial and propeller fans, at $52,316,413 last year, were down 5% from the $55,230,462 total in 1984.

The value of power roof ventilator shipments in 1985 was $75,265,726, an increase of 14% from the previous-year total of $65,882,433.

Shipment values for louvers, dampers, and shutters, at $61,125,237 in 1985, were ahead of the previous year's performance of $52,820,840 by 16%.



Centrifugal fans

Shipments in dollars
Baseline: 1977

AMCA in 1978 eliminated fans shipped to the power generation mar-

TURN TO PAGE 97

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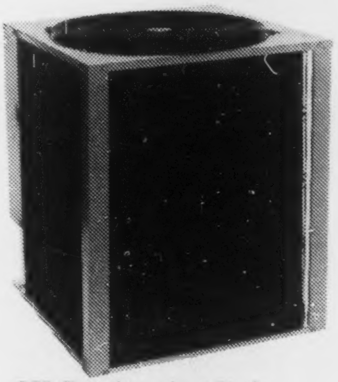

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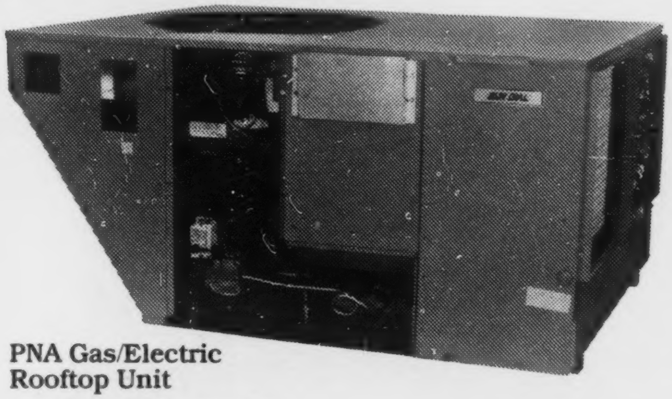


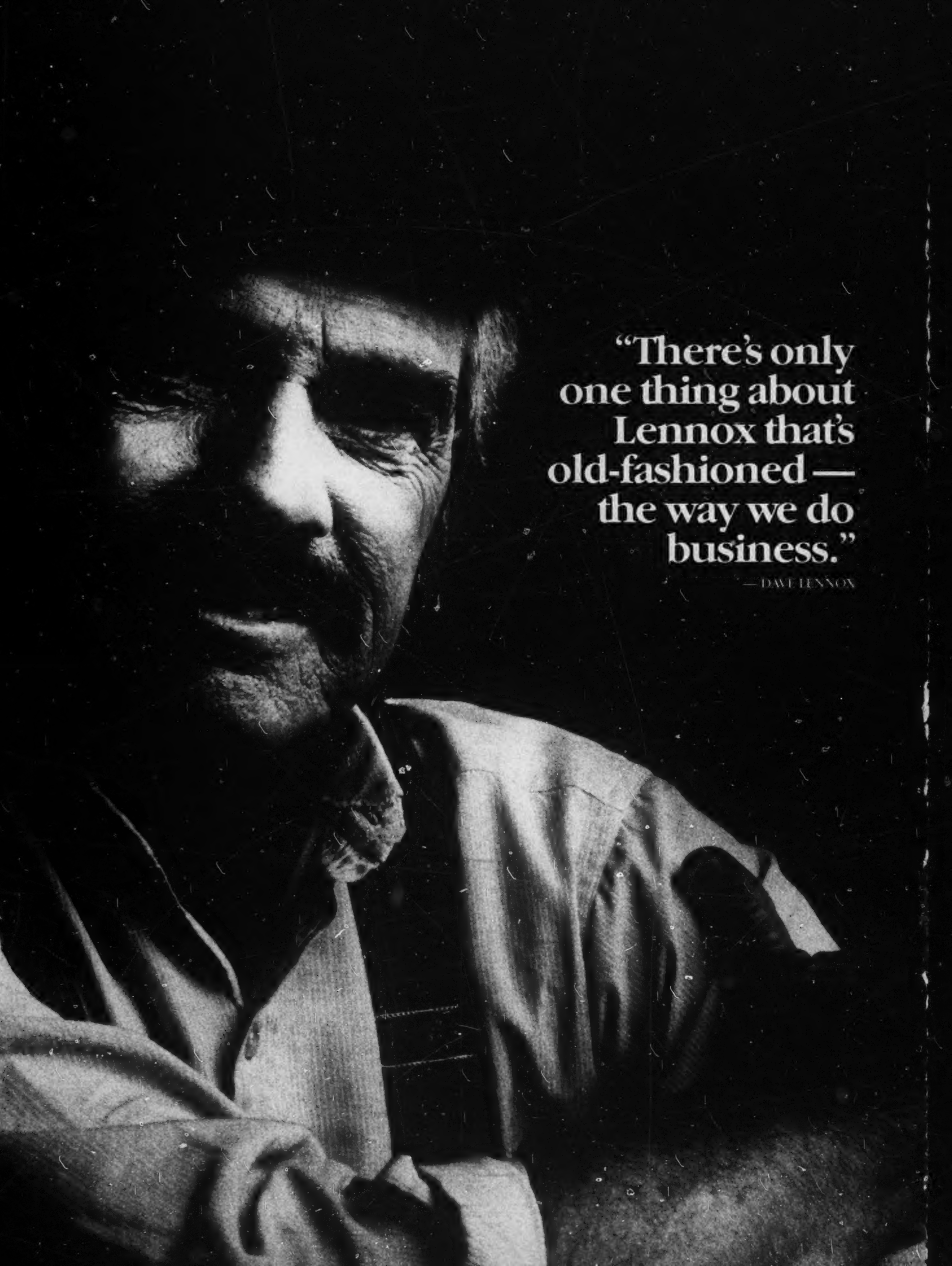
PNA Gas/Electric Rooftop Unit

COMMERCIAL

Discover Sun Dial Heating and Air Conditioning Products, a variety of models in both residential and light commercial with dependable, quality features that give your customers long lasting value. **Sun Dial's line helps you select the right combination that's right for the job.** We have the ratings you need to close a sale or satisfy a rebate program. Take a look at our lines, you'll find we have the sizes you need to make the right choice for the job or the sale. **It's easy**—Sun Dial, manufactured by the Square D Company, call us for a **FREE** catalog today at 214/288-7431.

SQUARE D COMPANY

Circle 53


"There's only
one thing about
Lennox that's
old-fashioned —
the way we do
business."
— DAVE LENNOX

"You need more than just quality products to build a successful business." At Lennox, we've always delivered quality products. Ours are among the most efficient, highest quality heating and cooling products money can buy.

But we know that even the best products only sell once if they're not backed by the kind of service and personal attention you deserve.

We've built our reputation on quality. But that's only one part of the entire Lennox picture."

"Naturally, we use advanced technology in our products. That leads to greater efficiency." Innovation is fundamental to achieving higher efficiency. That's why Lennox operates one of the most advanced research and development facilities in the industry — continually pushing the science of climate control up to new levels.

And as technology moves up, the costs of heating and cooling go down. Our Pulse™ combustion chamber is a perfect case in point. Using this exclusive technology, the Lennox Pulse furnace can deliver a remarkable 97% fuel efficiency. With that kind of efficiency, Lennox products practically sell themselves.

"Dealing directly with our customers gives our products an added value — the value of confidence." At Lennox, we've always thought that the best chain of distribution has only two links: us and you. Short chains leave no room for confusion or misinterpretation (or added costs). They help to inspire mutual confidence.

And frankly, we enjoy working directly with our Lennox dealers. We get the direct feedback we need to make our products and services even better. And it gives you the benefit of sound answers, sound service, and solid satisfaction.

"At Lennox, you're much more than just a customer. You're a part of the family." Yes, we're still a family-owned company. And we still believe in the old-fashioned values that make families strong. Like respect, honesty, integrity and consideration. They're as vital to our business as they are to yours.

And as a part of the Lennox family, our principles are yours. Share our commitment to modern technology, greater efficiency, and above all, old-fashioned business values.

LENNOX
THE EFFICIENCY EXPERTS

Circle 29

USA

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Money-Makers for Contractors...#8 in a Series.

THE ELECTRONIC AIR CLEANER.

QUALITY...THE INSIDE STORY.

Don't judge an electronic air cleaner by its cover. Because it's what you *can't* see in the Honeywell Electronic Air Cleaner that makes all the difference.

HIDDEN EFFECTIVENESS

Inside is Honeywell's specially designed protective screen that effectively pre-filters lint and larger dust particles. So the air cleaner stays more efficient longer. And there's less pressure drop than in other electronic air cleaner protective screens that clog easily.

Behind that, is Honeywell's Super Cell—a rugged, highly efficient unit with more collector plates spaced closer together, to filter up to 95% of the dust (ASHRAE Std. 52-76), smoke, pollen, and other particles smaller than one micron. Customers like its easy removal and dishwasher cleanup.

And both the pre-screen and Super Cell are surrounded by a tough, corrosion-resistant galvanized cabinet.

HIDDEN TIMESAVERS

Honeywell quality works for you, too. Because you won't spend a lot of time on callbacks with a Honeywell Electronic Air Cleaner.

Our power supply is dependable, proven over time to deliver years of trouble-free service. And in the unlikely event that a problem does pop up, it's built for easy serviceability.

And, Honeywell's exclusive test button lets customers prove that their air cleaner is working properly. So you get fewer "false alarm" service calls.

HIDDEN PROFITS

Best of all, here's the inside story on profits: Today's customers want quality and will pay for it. They know a quality product is cheaper in the long run. And they know Honeywell has always meant quality. And value. And efficiency.

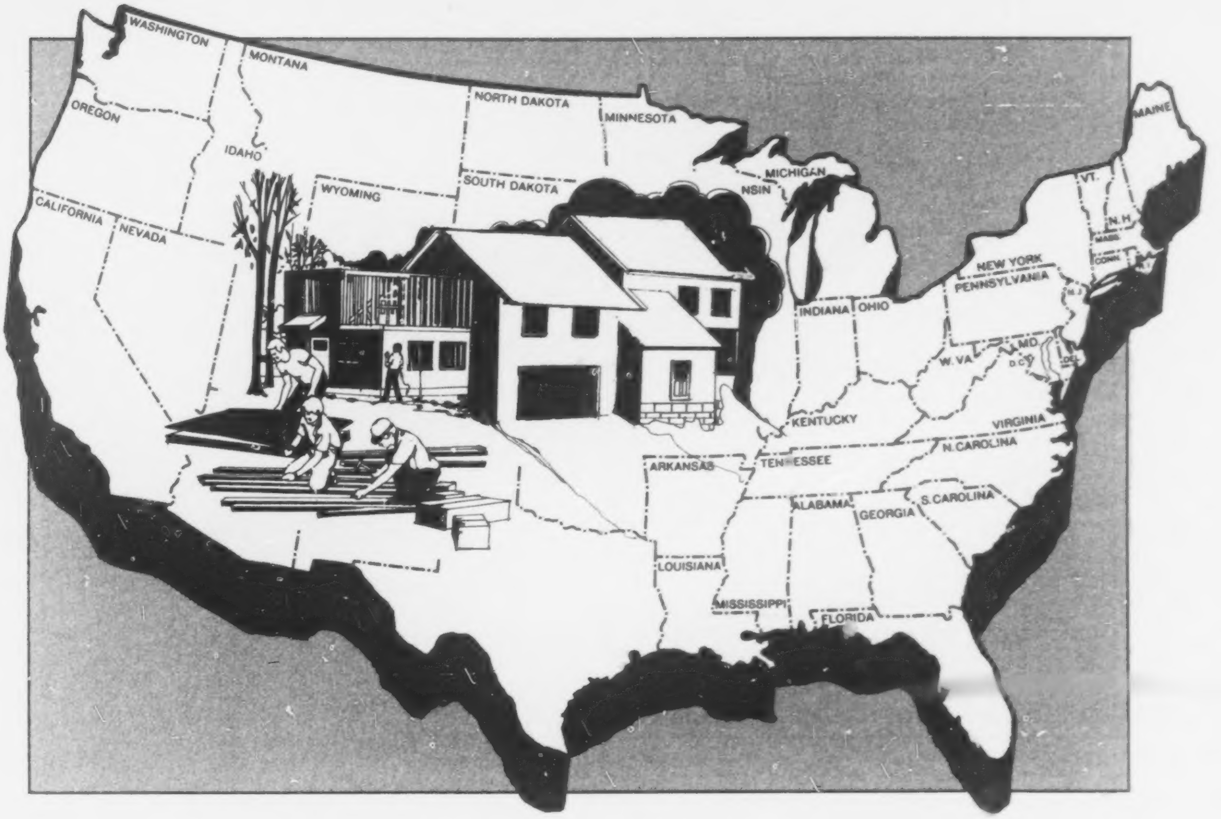
Why lose profits from a big ticket sale by specifying something else—or nothing at all? And why risk your company's quality image by installing anything less than a Honeywell?

Clean up by fighting dirty. With Honeywell. Ask your wholesaler or Honeywell representative about the contractor's Electronic Air Cleaner Demo. And turn Honeywell's inside story into a profit story for you.

Together, we can find the answers.

Honeywell

Circle 25


WASHINGTON
MONTANA
OREGON
NORTH DAKOTA
MINNESOTA
MAINE
IDAHO
WYOMING
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D.C.
DEL
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VIRGINIA
N. CAROLINA
ARKANSAS
TENNESSEE
ALABAMA
GEORGIA
S. CAROLINA
LOUISIANA
MISSISSIPPI
FLORIDA

10-year state housing starts show mixed building pattern

Here are housing starts for the 50 states and the District of Columbia for the period 1975-1984, as compiled by the National Association of Home Builders.

For many states, the pattern is fixed, with a gradual increase from 1975 to 1980, when housing starts dropped nationally, only to pick up again in 1983.

The 10-year period was one in which the saturation of home air conditioning reached its current level — about 70% of single family homes and 90% for multifamily units.

Not all states were equally affected by the decade's ups and downs. Some, like California and Florida, were volatile, with a "sawtooth" pattern. Others, like Nebraska and Oregon, have seen a five-year decline from their 10-year average.

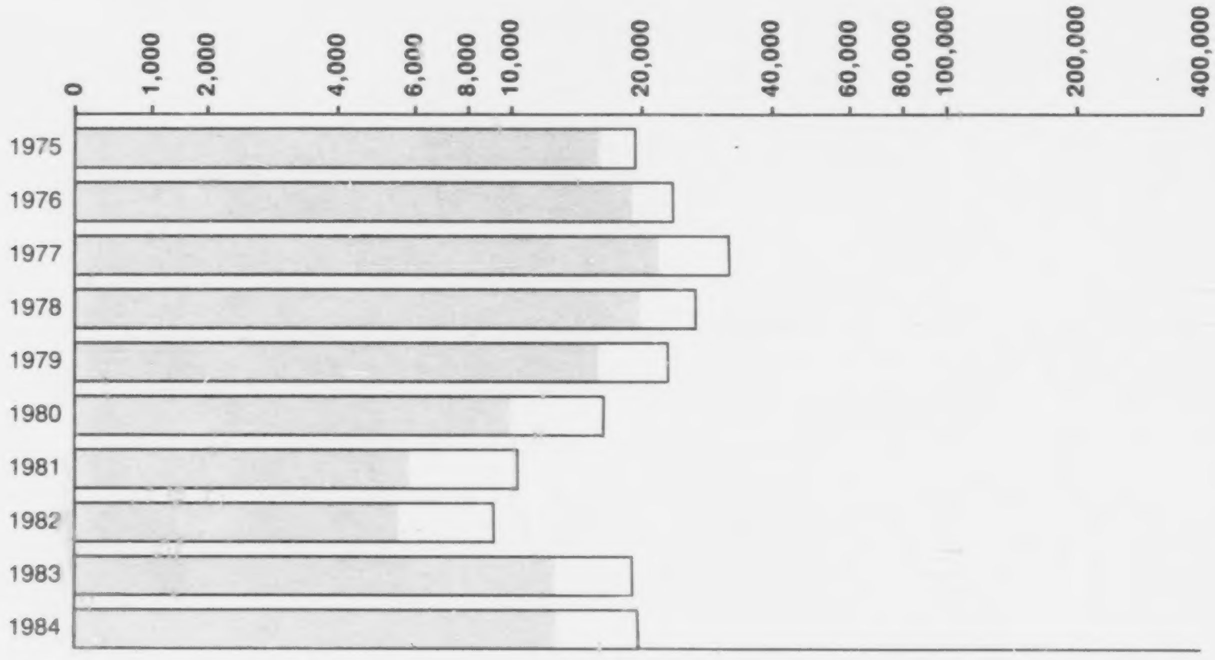
Housing construction continues to offer the largest single market for heating-cooling equipment, although the replacement market grows bigger each year. Housing constructed in the 1960's now becomes significant for the volume of 20-year-old air conditioners, furnaces, and humidifiers it represents.

Similarly, the housing activity shown in the following pages represents tomorrow's replacement market. Large states like California, Texas, and Florida are enormous markets for efficiency-upgraded air conditioning systems. Northern-tier states like Illinois, Michigan, Ohio, and Wisconsin are chock-full of low-efficiency builder-model furnaces now 20 years old.

So the hvac industry gets a "double dip," selling its products to the builder market and the replacement/add-on market. And despite the current downturn in oil prices, the efficiency-upgrade market continues strong.

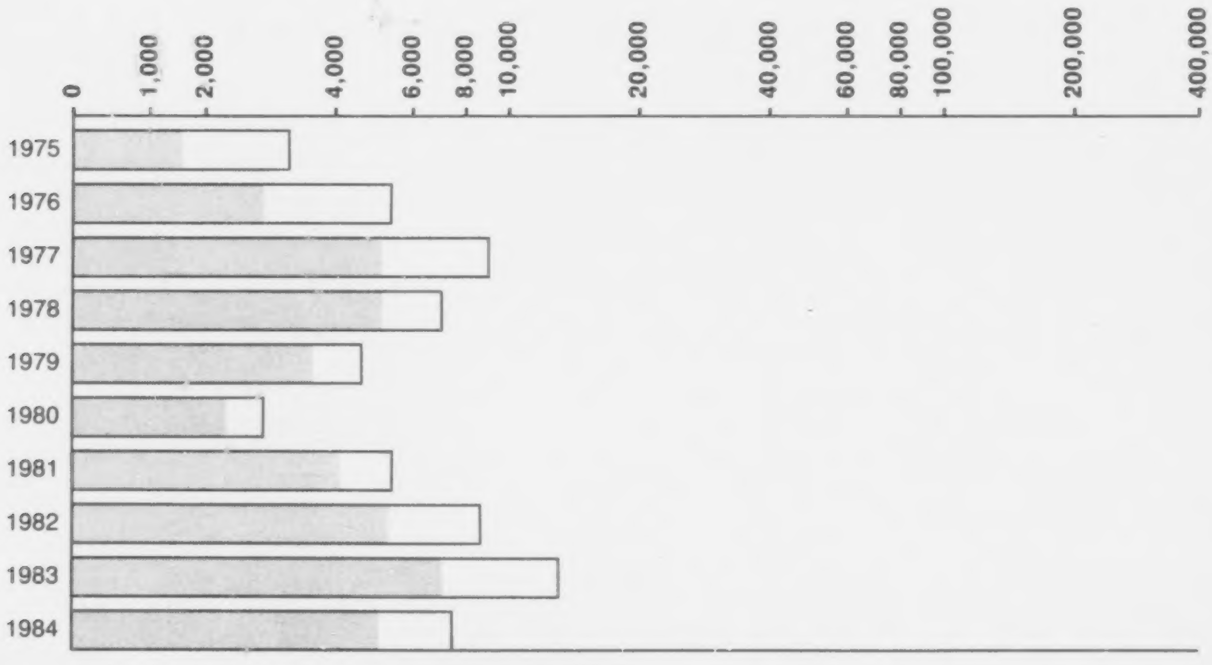
ALABAMA-ALASKA

ALABAMA

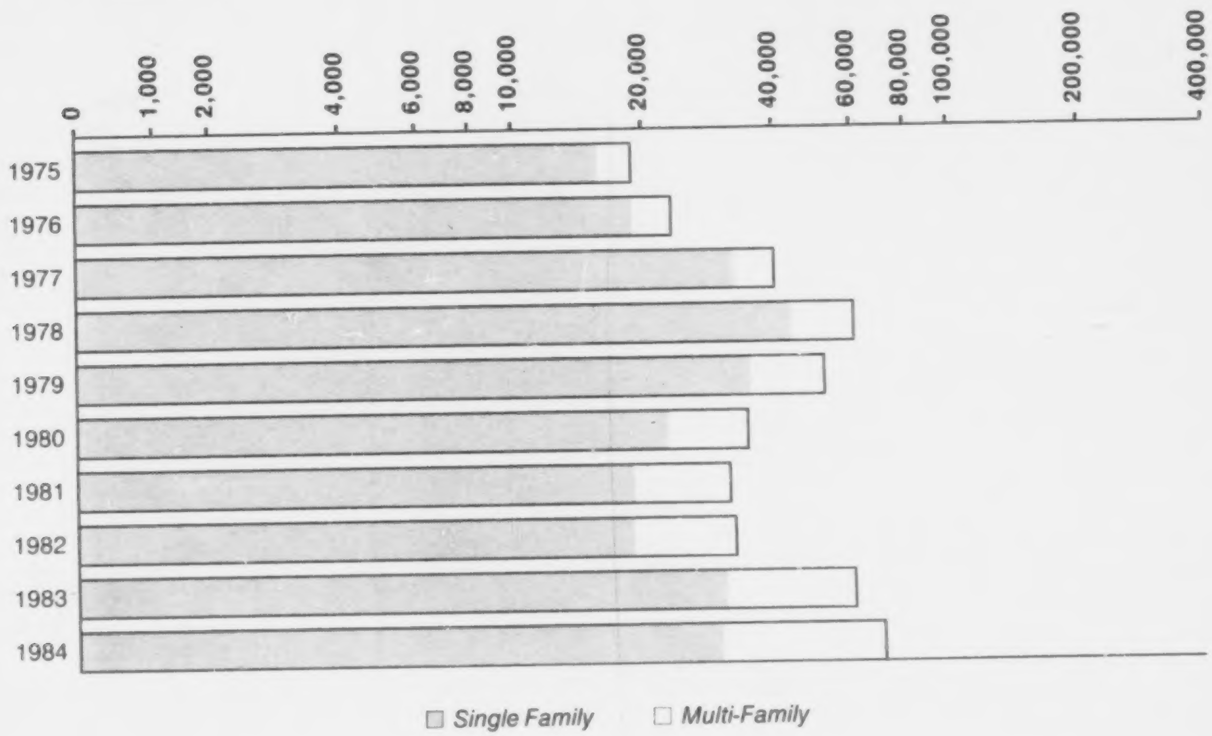


☐ *Single Family* ☐ *Multi-Family*

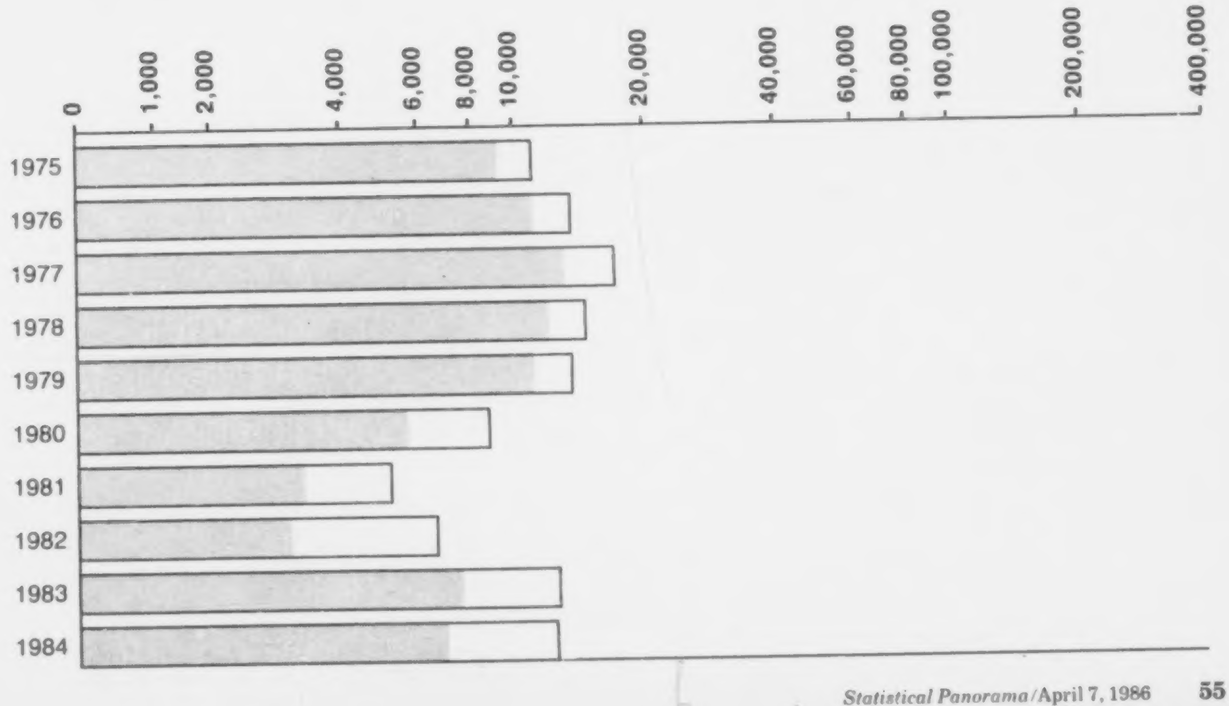
ALASKA



ARIZONA



ARKANSAS



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Makes the Jobs Easy.

America's First Choice for Insulation, Tube Kits, & Copper Tubing

From One Great Source

#1 in Product Variety

Halstead products are offered in a complete and complementary system, so you don't waste time shopping different sources. It's all there: Halstead insulation, tube kits, copper tubing and accessory products. One source for everything you need to do the tough jobs right.

#1 in Quality that Lasts.

You put your name on the tough jobs you do. Your reputation depends on the quality of the products you use. That's why the Halstead name needs to be on the materials that go into your jobs. When the jobs get tough, the tough get Halstead.

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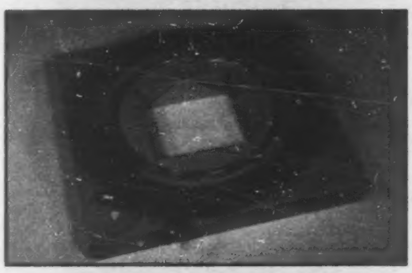
Insul-Tube® tube & sheet insulation

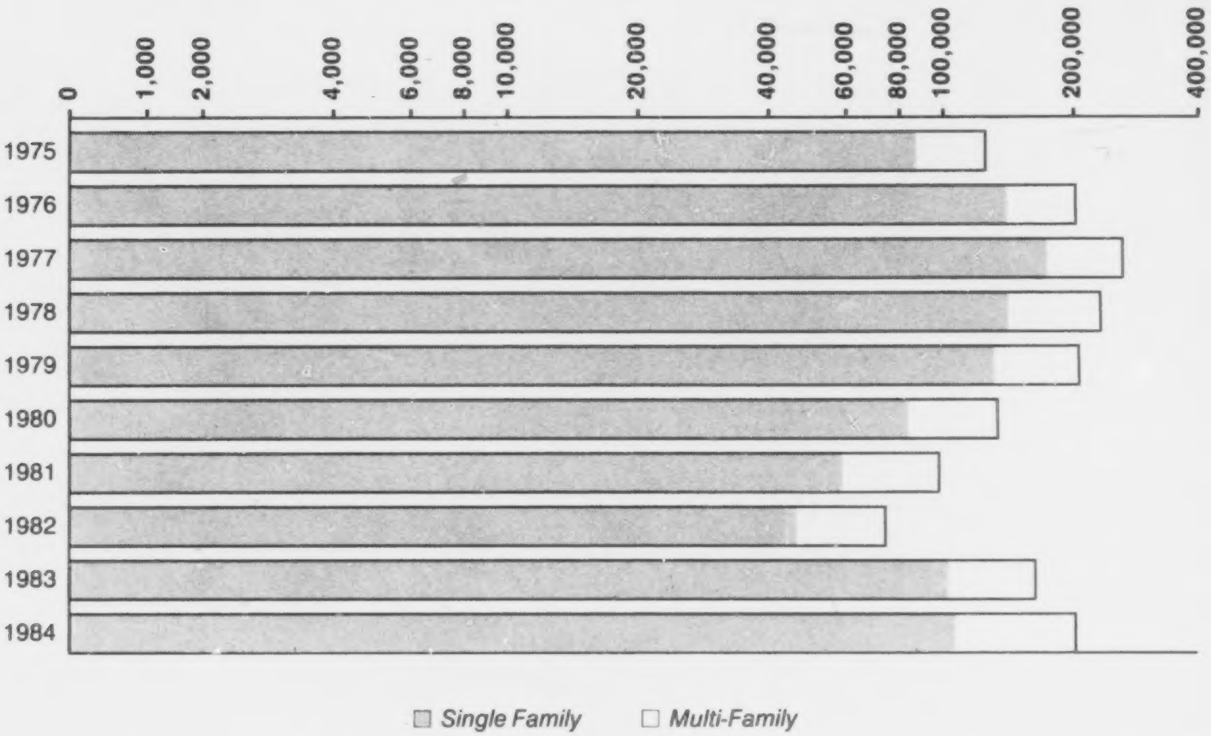


Tube kits

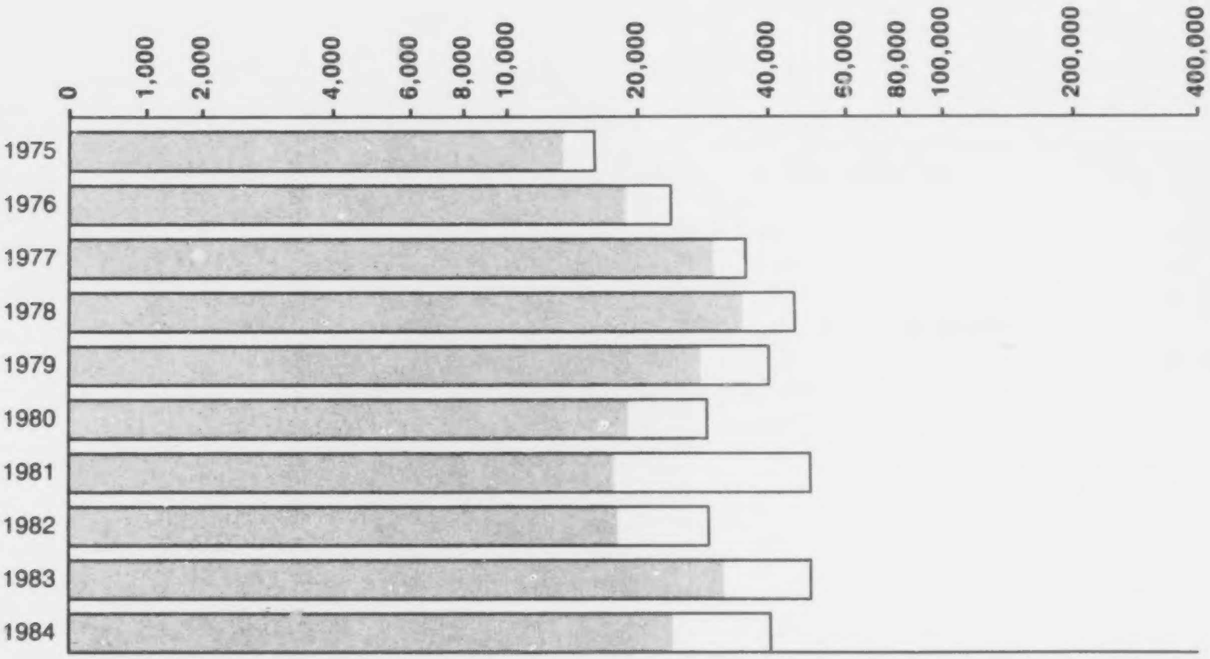
Copper tubing

CALIFORNIA-COLORADO

CALIFORNIA



COLORADO



Comfort-Aire®...

Cool Answers To Hot Problems.

(Room Air Conditioners–Full Line)

If your customer has a room that needs to be cooled, we've got an air conditioner that will do the job in style. Comfort-Aire has room air conditioners ranging from the 4,800 BTU/HR Rotary Compact-Aire to the 34,000 BTU/HR Super Power-Aire.

Our wide range of models and options means you can count on just one source to meet many special needs.

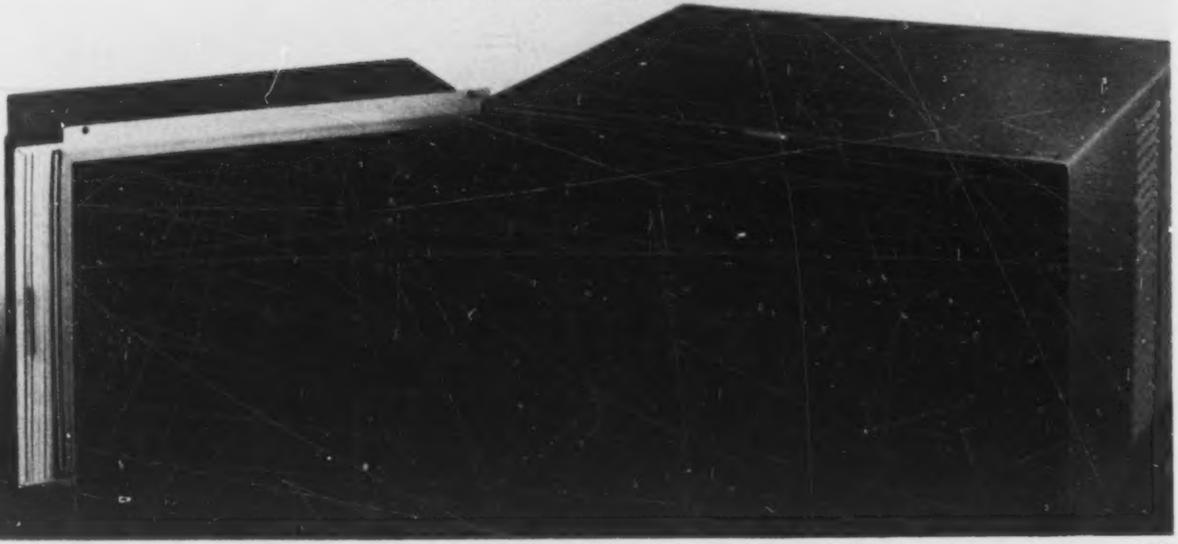
Here are a few of the many Comfort-Aire features:

- Units that can be mounted through the window or through the wall.
- Units to fit single- and double-hung windows, casement windows and horizontal sliding windows.
- A Year-Round model for summer cooling and winter heating.
- Hidden controls and automatic thermostat.
- Fine simulated woodgrain finish cabinets.
- Slide-out chassis design for easy maintenance.

You can count on Comfort-Aire, a leader in the air conditioning field.

HEAT CONTROLLER, INC.
JACKSON, MICHIGAN 49203

The Quality Leader in Conditioning Air



Circle 22

a family of direct digital controls you can mix and match

The M100 Motor Actuator. It's nice to have a variety of plug-in boards available as well as a special digital board set for the DSC1000 family.

The new DSC1000 family is not just one big monsterous control for a variety of HVAC applications. Johnson Controls engineers designed it to incorporate several different functions into separate units that can be used as either a stand alone system, or as part of a network of subsystems tied into a higher level digital controller. It's a family of controls that lets you tailor the system to your exact wants. And that means you won't be paying for functions you don't need. It's the brightest new way of applying microcomputer technology. And when you use it, you're going to say, "Hey,

"that's nice,
Johnson!"

The N500 Digital To Proportional Interface. This interface receives and then translates digital control signals to existing pneumatic or electronic actuators. It makes retrofit applications nice and simple.

The S500 Staging Module. It very nicely eliminates external time delay relays. And you can plug in relay packs for the number of stages you want.

JOHNSON CONTROLS
Goshen, IN U.S.A.

The Y199 Service Module. This hand-held service tool gives you an LCD readout of the system's parameters. It's a nice easy way to set-up and diagnose.

JOHNSON CONTROLS
OUT PUT
SEN SITY
VALUE
NEX DATA
HA
EA
CA
HS
CS
1
2
3
4
5
6
7
8
9
0
OVER RIDE
RES PONSE
CAN CEL
ENTER
DIS PLAY
Y199AA-1

The C500 Controller. The heart of the family where all inputs and outputs originate. What's extra nice is there's no programming required.

We put you in total control

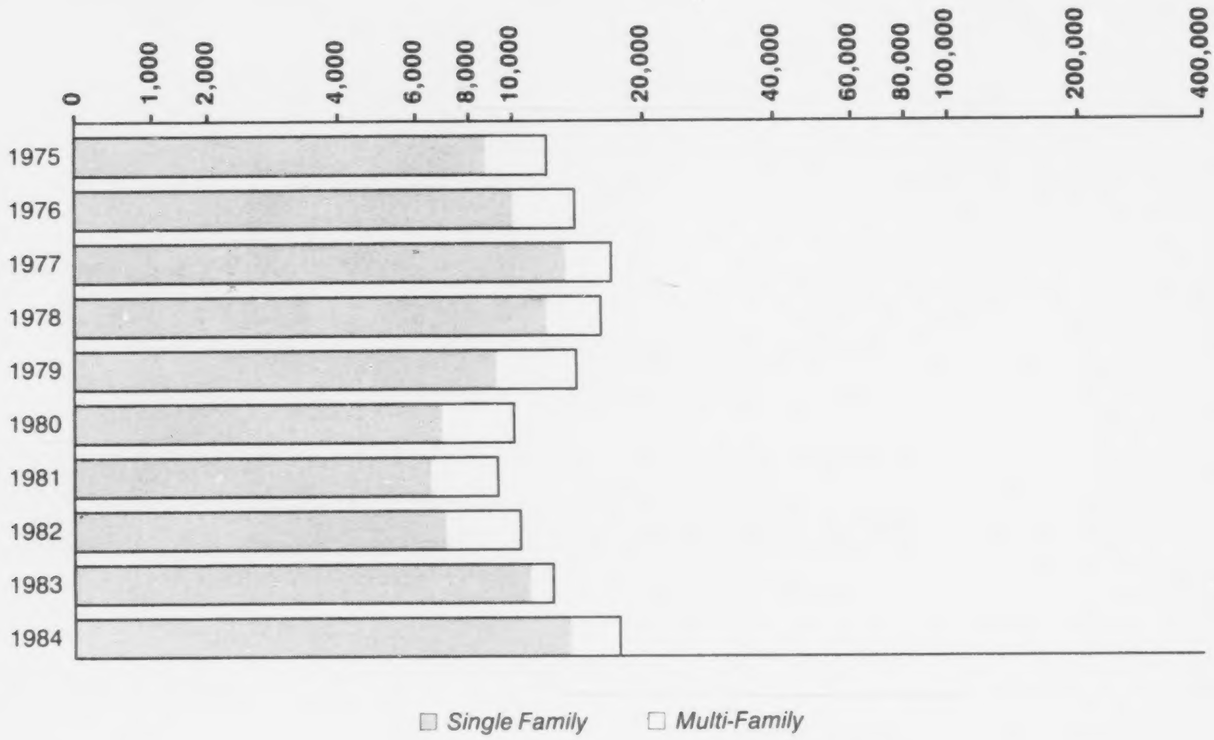
JOHNSON CONTROLS

100 YEARS

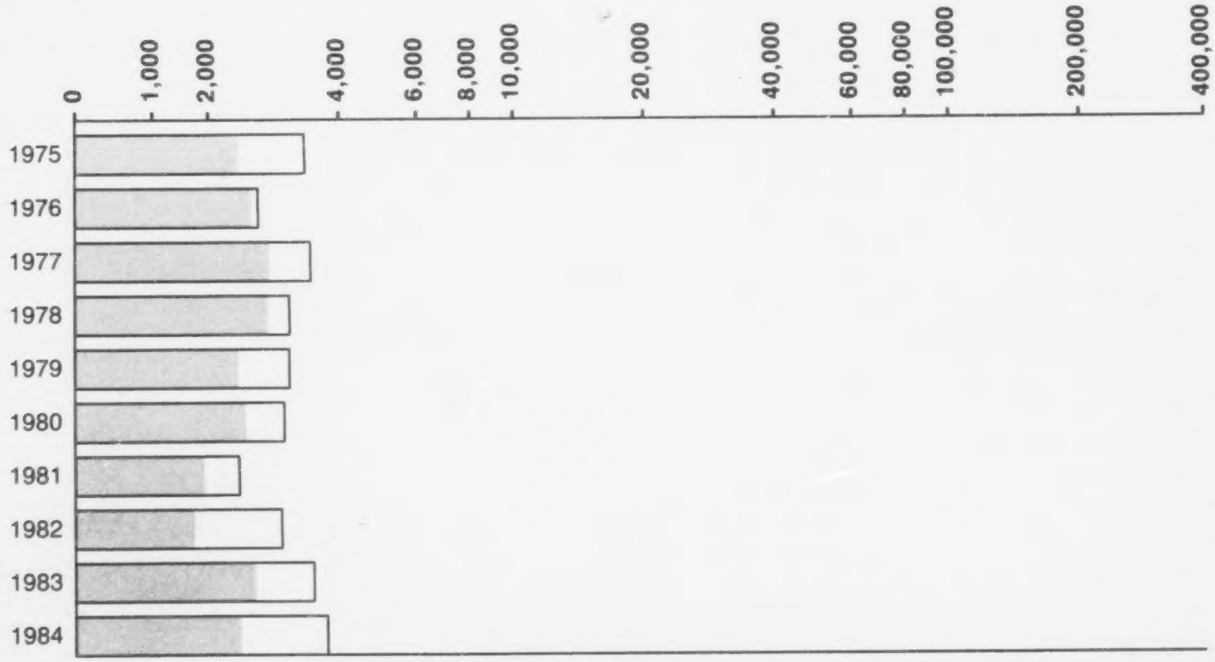
Control Products Division
1250 E. Diehl Road, Naperville, IL 60540
429 Warden Ave., Scarborough, Ontario M1L 4C6

Circle 28

CONNECTICUT

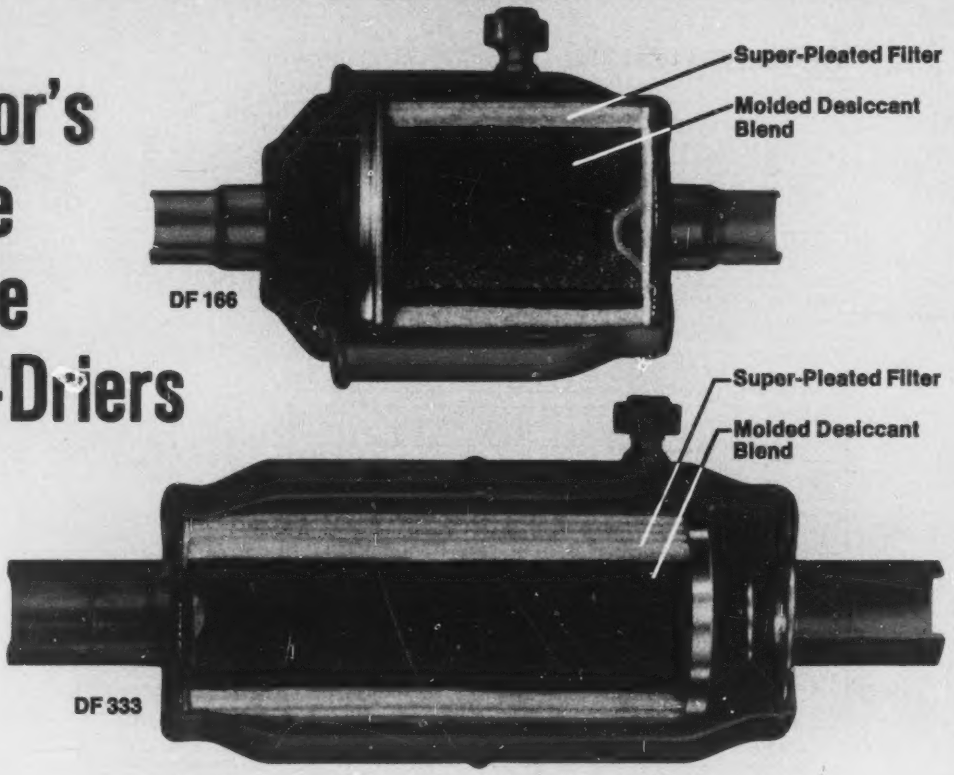


DELAWARE



Clean-ups are our business...

Use Superior's Sealed Type Suction Line Filter-Plus-Driers



Designed specifically for heat pumps as well as commercial air conditioning and refrigeration systems

- Compact design ideal for heat pumps.
- Super pleated filter, housing a molded cake of desiccant blend, is a Superior exclusive.
- Filter area is at least twice that of any other available suction line filter-drier.
- Solid contaminants down to 10 microns in size are filtered out *before* refrigerant stream flows through drier core, permitting the drier to do its intended job—removal of moisture and acid. Solid contaminants never reach the drier core.
- Drier core is high capacity blend of activated alumina and molecular sieve.
- More than 50% of filter area can be clogged without increasing pressure drop, a Superior exclusive.

Solid copper end fittings (not plated steel) for easy brazing

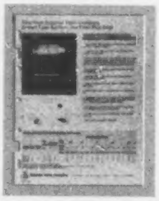
- End fittings are high temperature brazed to steel body shell to permit silver brazing installation.
- Access valve at inlet end permits easy check of pressure drop.
- Safe working pressures to 300 PSIG.
- Steel shells treated to resist corrosion and insure long life.
- Welded and brazed joints are made in inert atmosphere to prevent formation of oxides which contribute to formation of acids and subsequent system failure.
- DCI vendor No. 687728.

DF166 Available in sizes ½", ⅝", ¾" and ⅞" ODs. Ratings through 8 tons.

DF333 Available in sizes ⅝", ¾", ⅞", 1⅛", 1⅜" and 1⅝" ODs. Ratings through 14 tons.

ARW
Air Conditioning and Refrigeration Wholesalers
Associate Member

Send for data sheets that give full details on these Superior DF166 and DF333 Series Filter-Driers

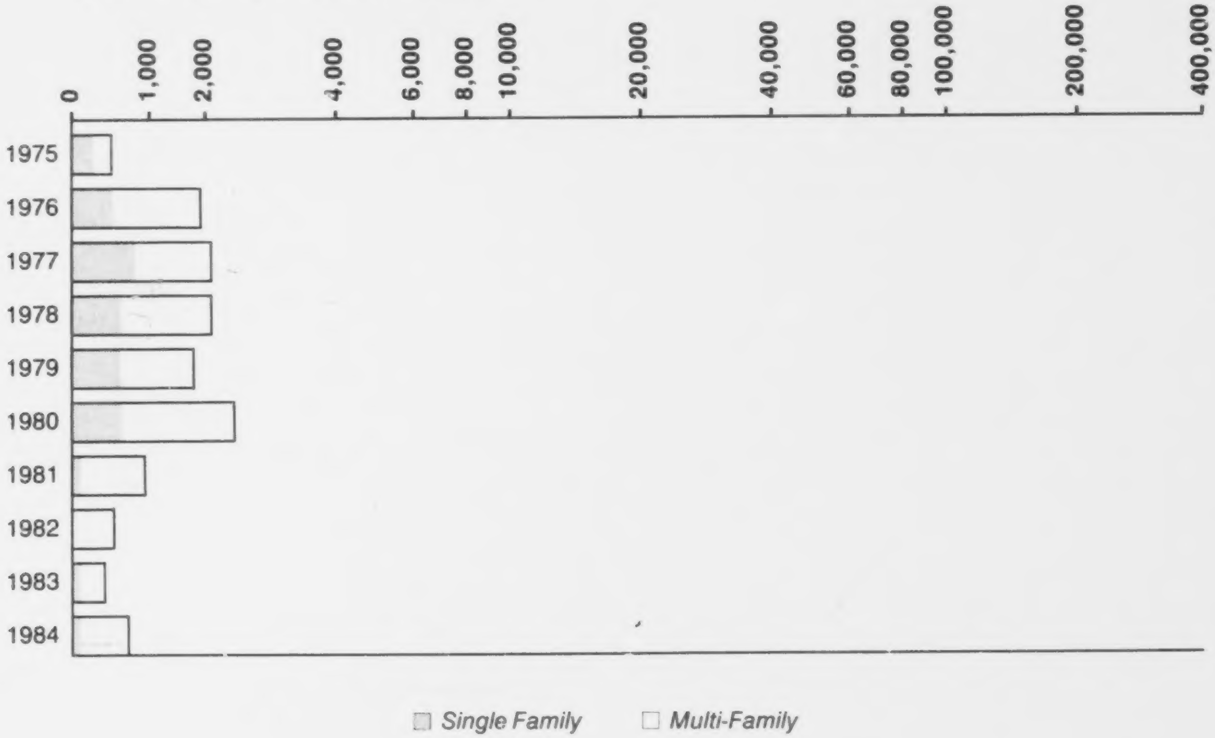


Superior
Valve Company
2200 N. Main St., Washington, PA 15301

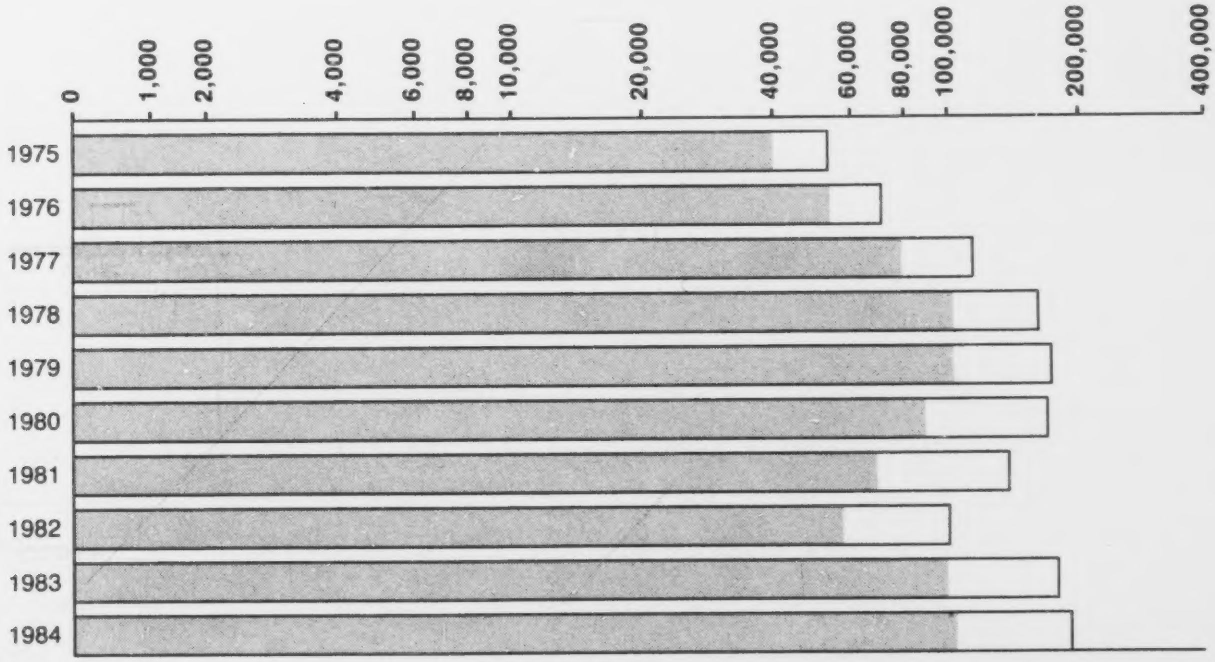
5 coast-to-coast warehouses back up your local wholesaler's stocks.

Circle 57

DISTRICT OF COLUMBIA

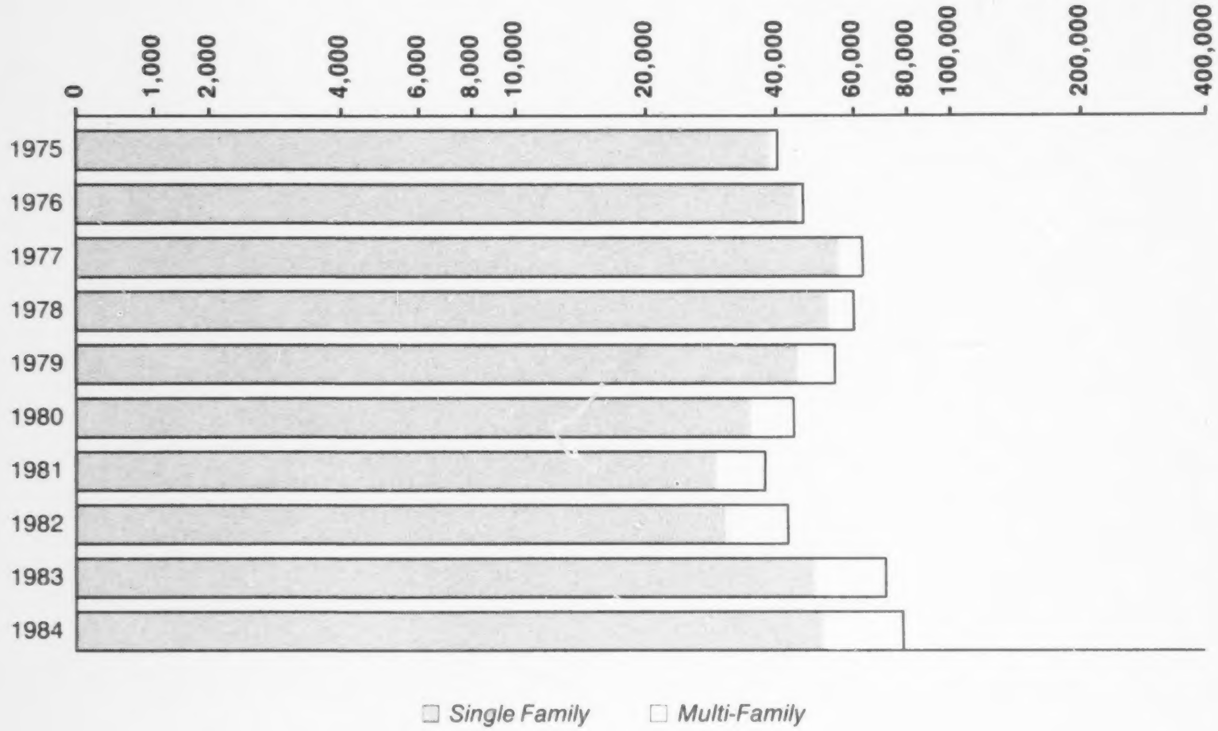


FLORIDA

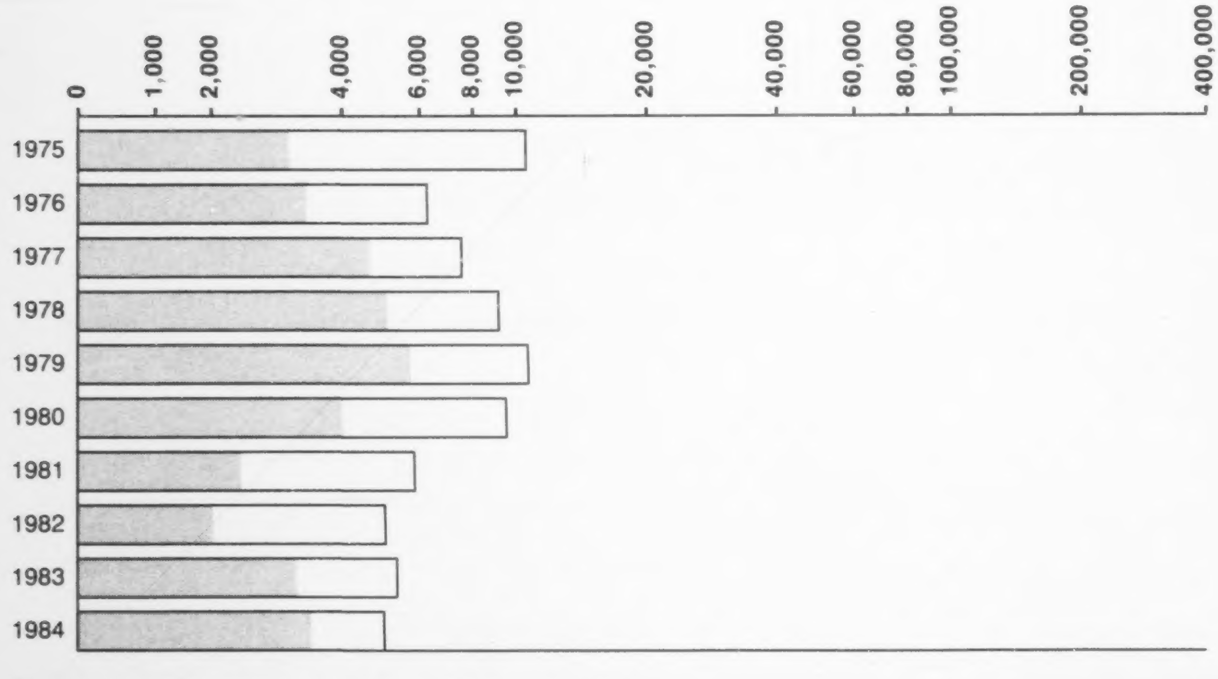


GEORGIA-HAWAII

GEORGIA

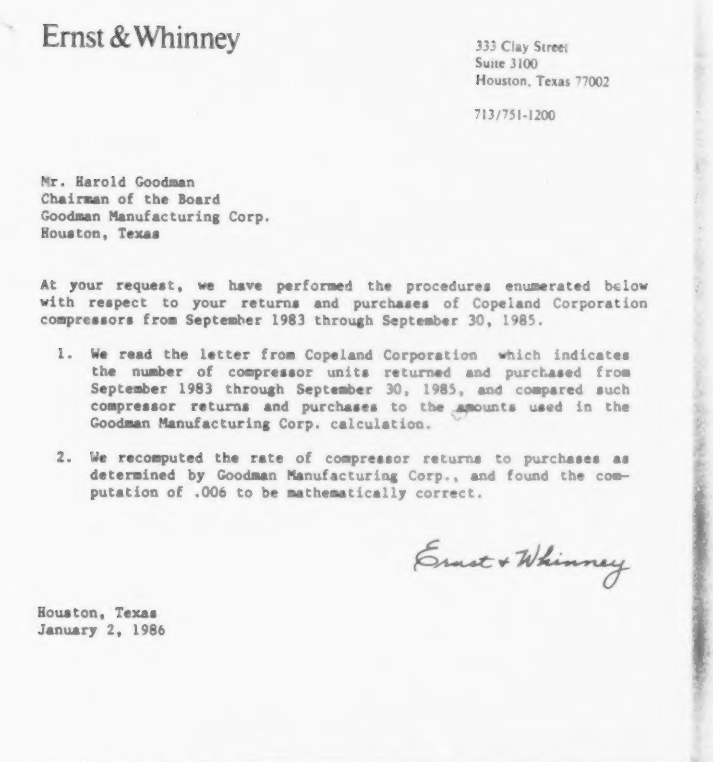


HAWAII



Outstanding Performance at an Unbeatable Price

Janitrol's Annual Compressor Failure Rate Is Only 1 In 167



Ernst & Whinney

333 Clay Street
Suite 3100
Houston, Texas 77002

713/751-1200

Mr. Harold Goodman
Chairman of the Board
Goodman Manufacturing Corp.
Houston, Texas

At your request, we have performed the procedures enumerated below with respect to your returns and purchases of Copeland Corporation compressors from September 1983 through September 30, 1985.

1. We read the letter from Copeland Corporation which indicates the number of compressor units returned and purchased from September 1983 through September 30, 1985, and compared such compressor returns and purchases to the amounts used in the Goodman Manufacturing Corp. calculation.
2. We recomputed the rate of compressor returns to purchases as determined by Goodman Manufacturing Corp., and found the computation of .006 to be mathematically correct.

Ernst & Whinney

Houston, Texas
January 2, 1986

Verified by Ernst & Whinney, one of the Eight Largest Accounting Firms in the Nation

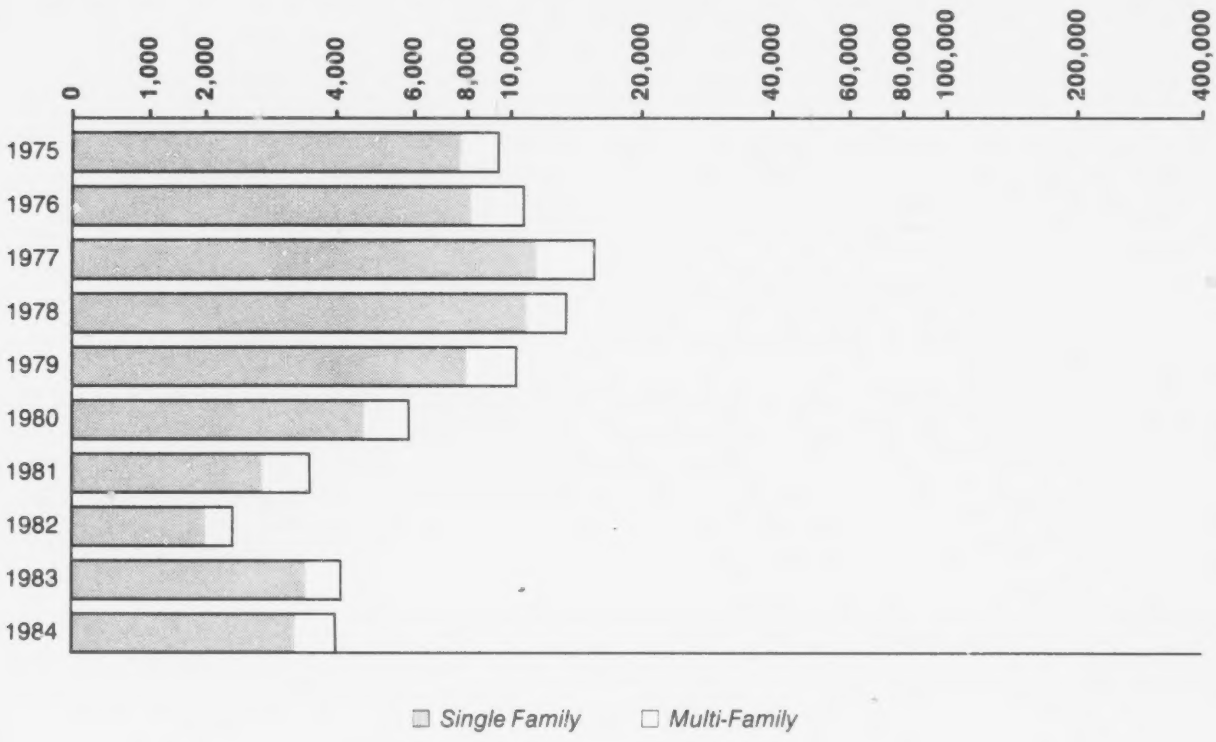
SINCE 1890
Janitrol
air conditioning & heating

Goodman Manufacturing Corp.
1501 Seamist • Houston, Texas 77008

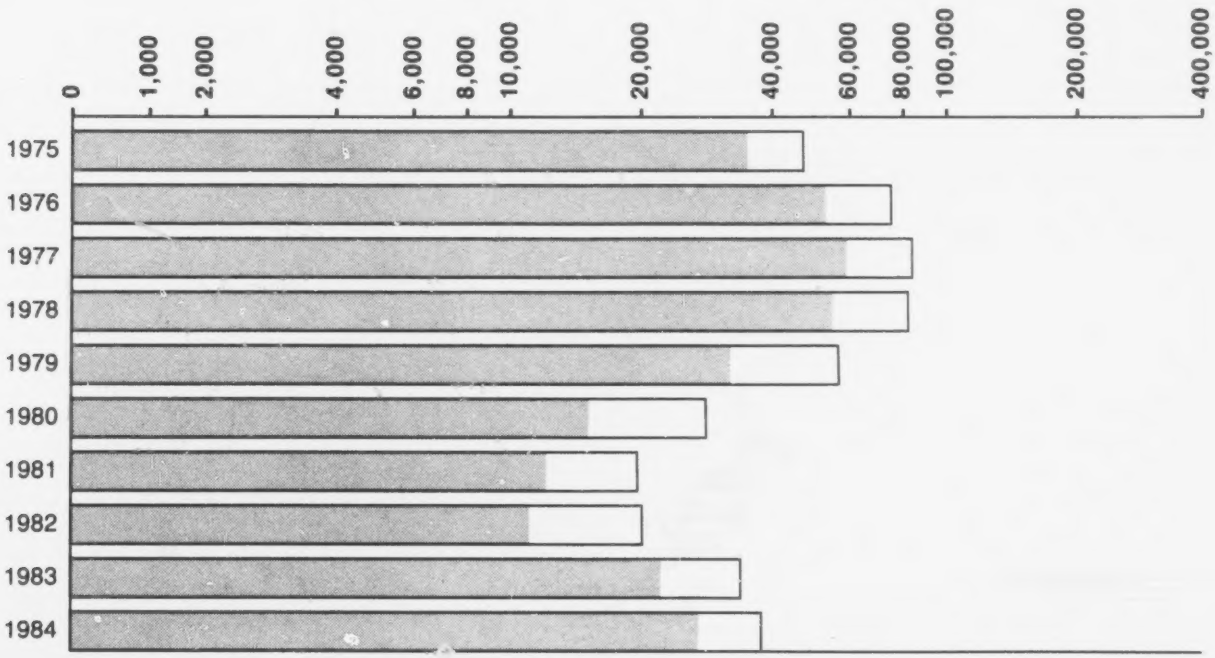
For More Information Call Our Sales
Department at 713-861-2500
or Call Your Local Janitrol Distributor

Circle 20

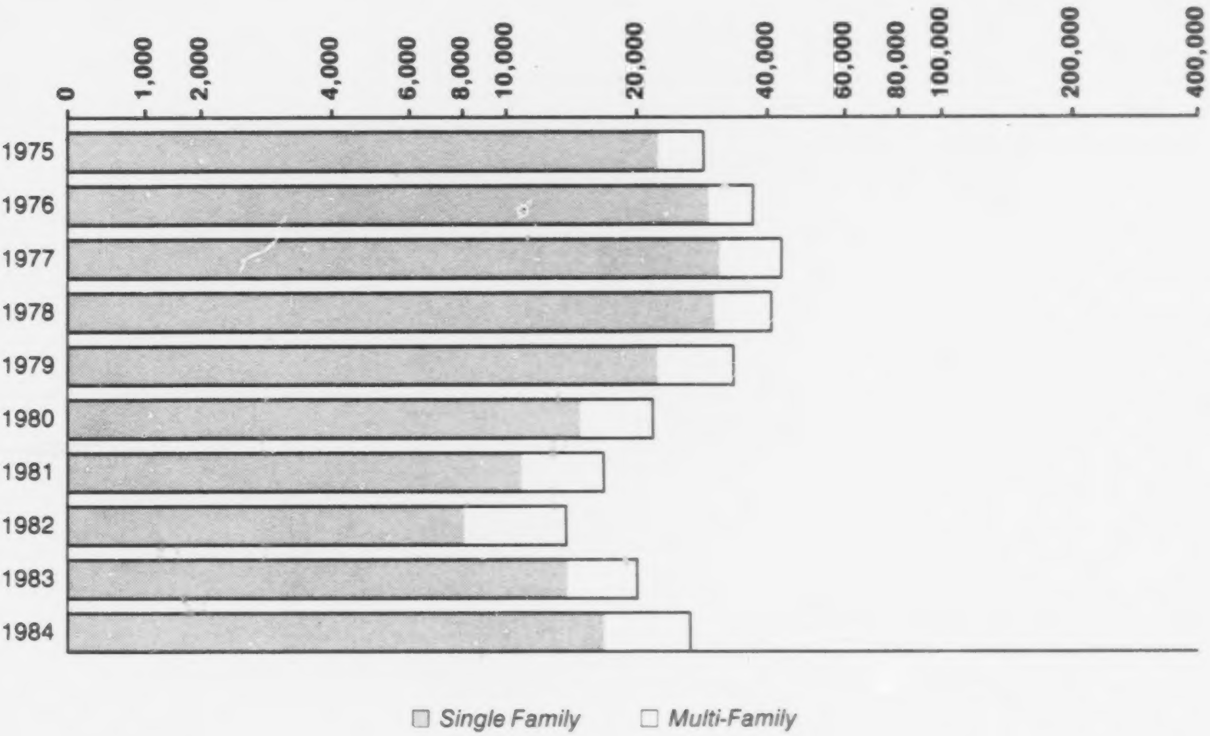
IDAHO



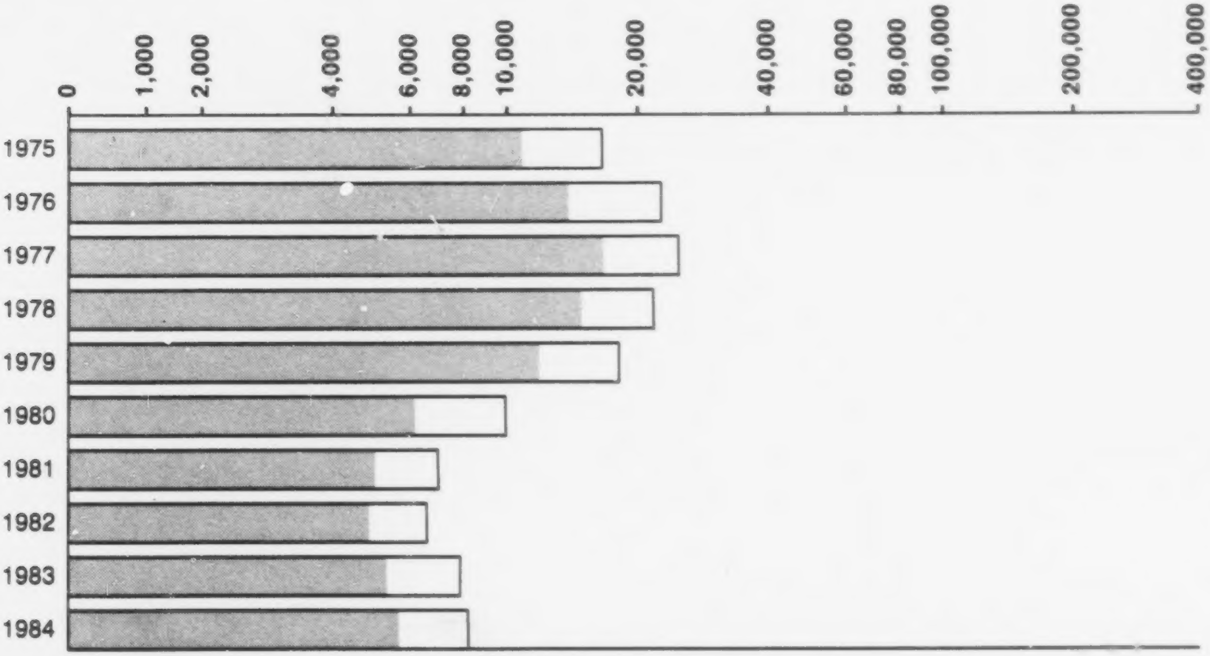
ILLINOIS



INDIANA



IOWA



The world's foremost testing laboratory for the HVAC industry

ETL

Depend on ETL for all your testing needs. Here are just some of the ways we can help:

As an Approvals Agency, ETL offers a nationally accepted safety label plus directory listing and follow-up service.

ETL offers complete performance testing on furnaces, boilers, water heaters, and room heaters.

ETL will provide performance testing for your unitary air conditioners, applied equipment, and refrigeration components and products.

ETL provides complete acoustical and air-flow testing for architectural requirements and mechanical products. ETL also offers testing of mechanical equipment in full-size room mock-ups.

ETL conducts a variety of tests on air filtering devices for your industry.

ETL is experienced in all facets of household, commercial, and industrial refrigerator and freezer testing.

Whatever the testing, approvals or certification requirements your product may need, there's only one name you have to know — ETL!

That's because ETL is a full service laboratory equipped and professionally staffed to handle all your testing needs. Our years of Performance Testing experience will provide your engineers with accurate testing results promptly. Our nationally accepted Safety Testing offers the labeling, listing, and follow-up services your marketing people depend on. And, we provide testing and administrative services in support of industry-wide performance certification activities.

Manufacturers large and small have learned that they can expect prompt, courteous, quality services from ETL. They know that if their product requires more than one type of testing, ETL's "one-stop" testing capabilities can save them precious time and money while also getting products to the marketplace faster.

Our regional laboratories are expanding our service across the country.

ETL operates multiple regional facilities conducting R&D, private performance tests, nationally accepted safety tests, and third party certification on almost any product, component, or material imaginable. Also, we test to government, industry, corporate, national, and international standards.

Find out how ETL can help solve your testing needs. For an immediate response, call our Cortland Headquarters on our toll-free number (except from Alaska, Hawaii, and New York).

(800) 345-ETL1

ETL TESTING LABORATORIES, INC.

Headquarters: Industrial Park, Cortland, N.Y. 13045 Tel: (607) 753-6711 TWX: 510-252-0792
Southeast: 5855-P Oakbrook Parkway, Norcross (Atlanta), GA 30093 Tel. (404) 446-7294
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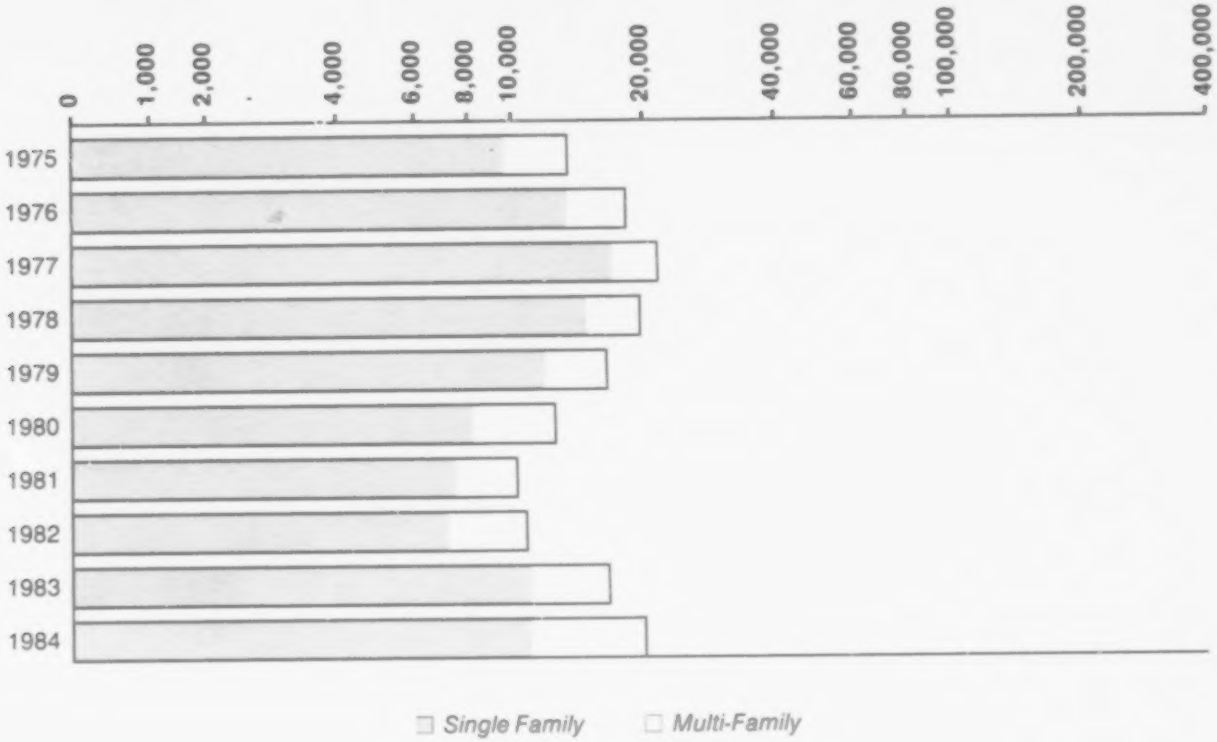
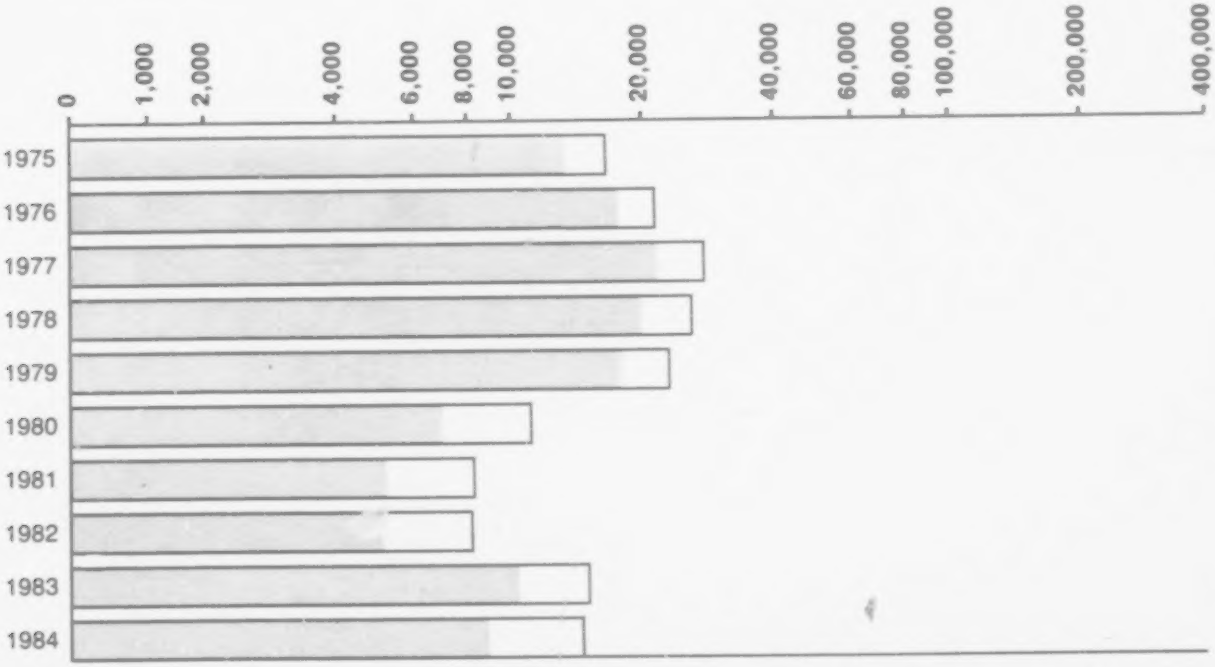
America's versatile product testing laboratory.

Circle 16

KANSAS

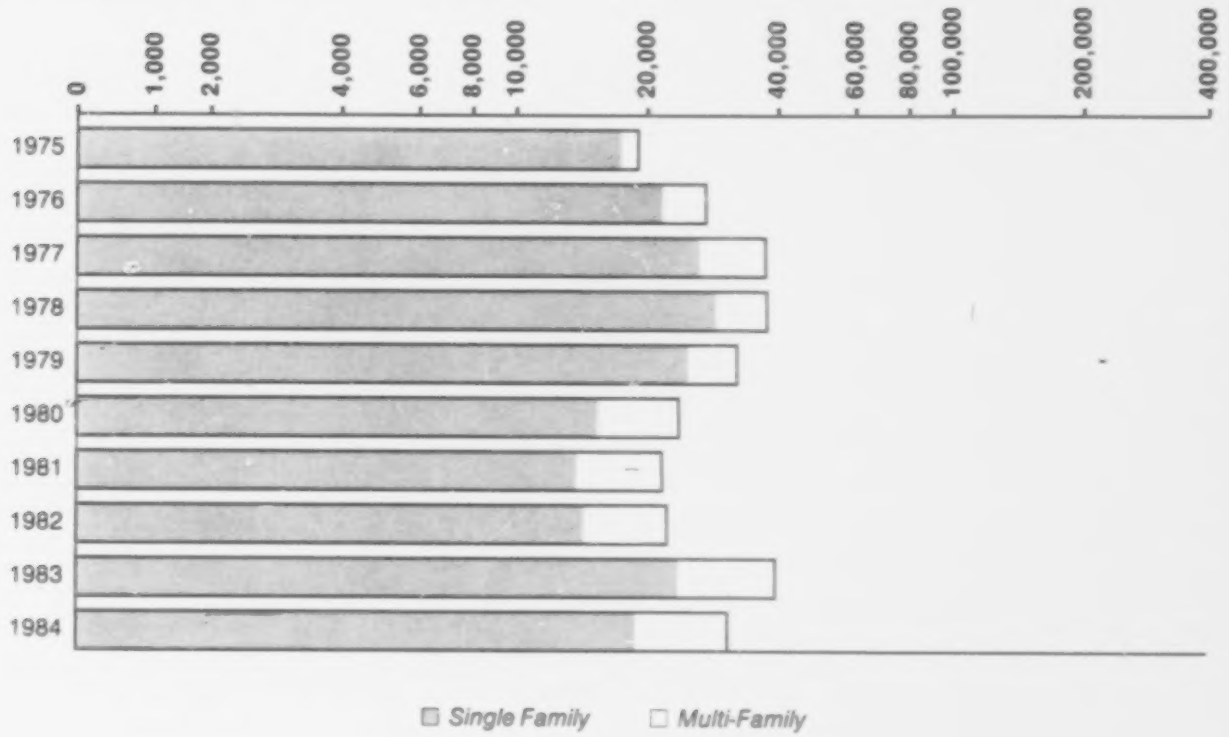


KENTUCKY

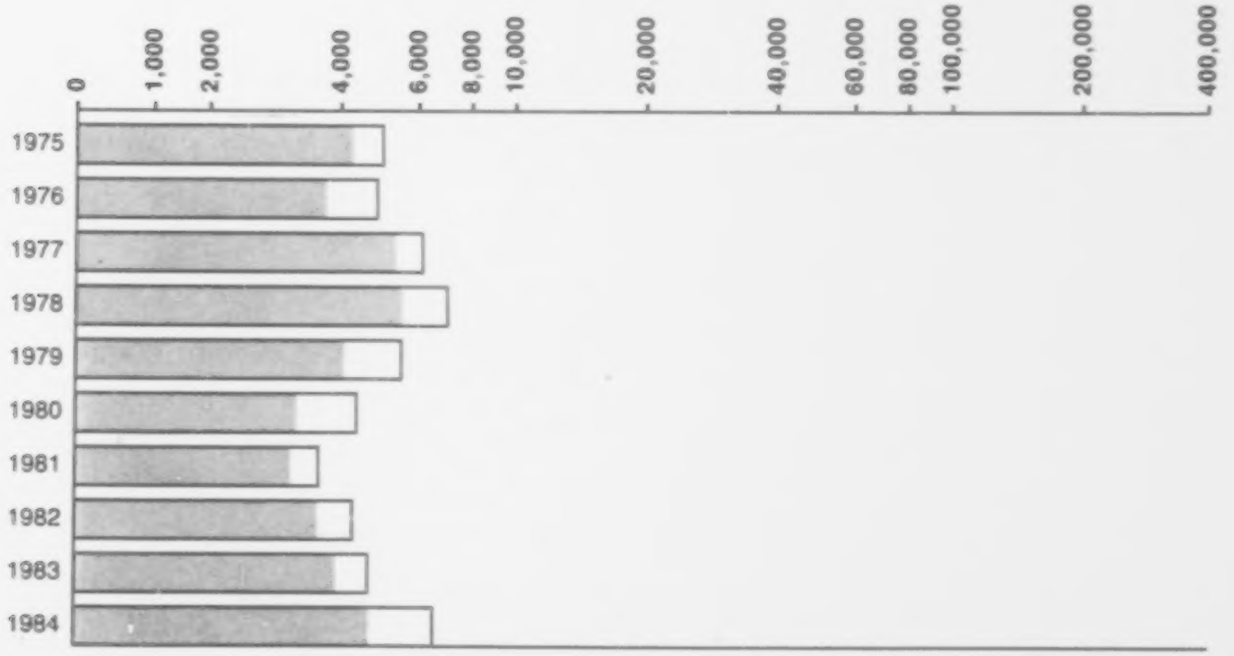


LOUISIANA-MAINE

LOUISIANA

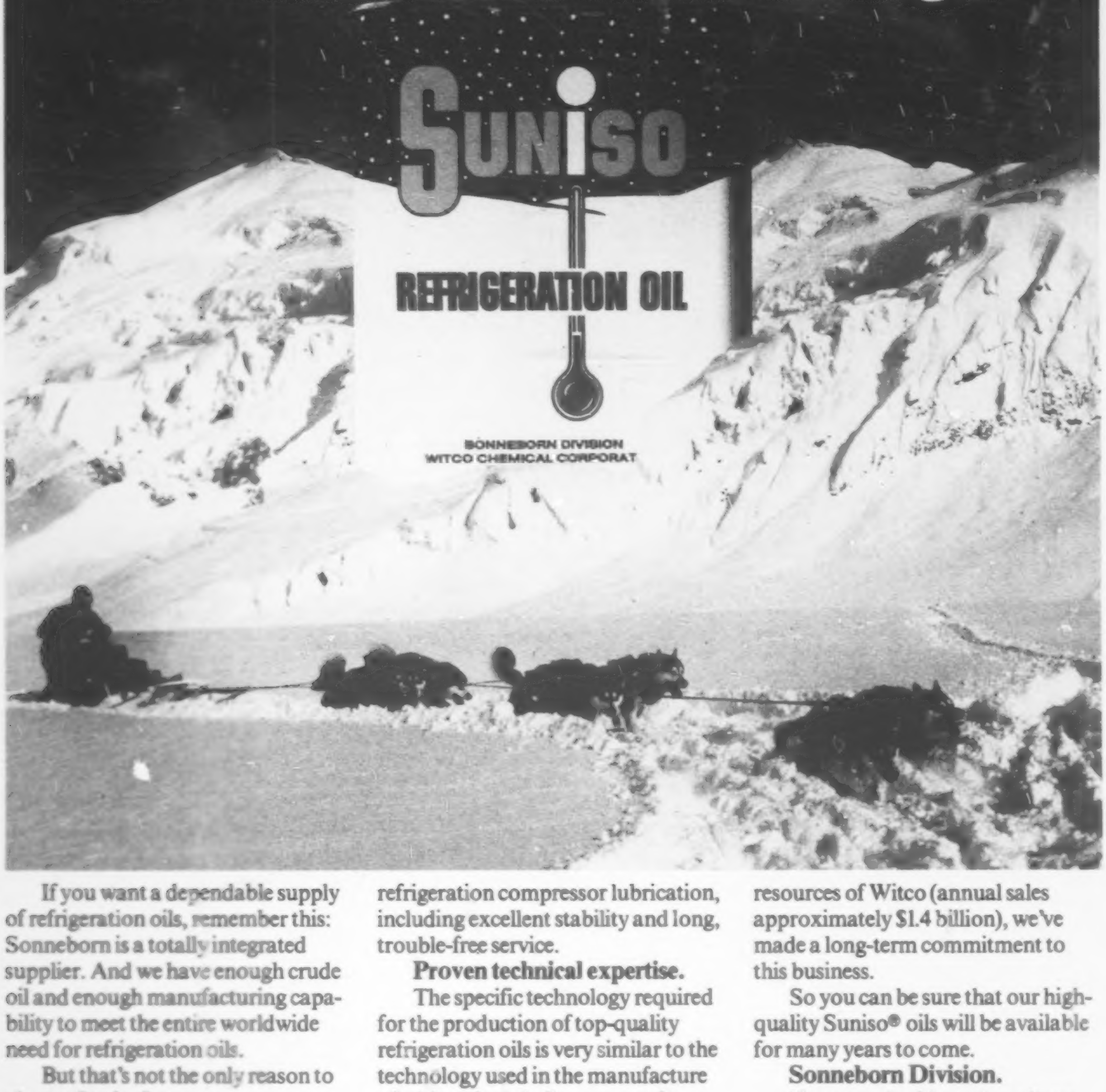


MAINE



9929

With refrigeration oil suppliers few and far between, you can count on Sonneborn to come through.



If you want a dependable supply of refrigeration oils, remember this: Sonneborn is a totally integrated supplier. And we have enough crude oil and enough manufacturing capability to meet the entire worldwide need for refrigeration oils.

But that's not the only reason to choose Suniso®

Proven product quality.

Suniso oils have been the industry standard for over 40 years. They have the physical properties to satisfy the most demanding requirements of refrigeration compressor lubrication, including excellent stability and long, trouble-free service.

Proven technical expertise.

The specific technology required for the production of top-quality refrigeration oils is very similar to the technology used in the manufacture of white mineral oils—an area in which Sonneborn has been the leader for more than 75 years. So you can count on us for the technical support you need.

And, backed by the worldwide resources of Witco (annual sales approximately $1.4 billion), we've made a long-term commitment to this business.

So you can be sure that our high-quality Suniso® oils will be available for many years to come.

Sonneborn Division.

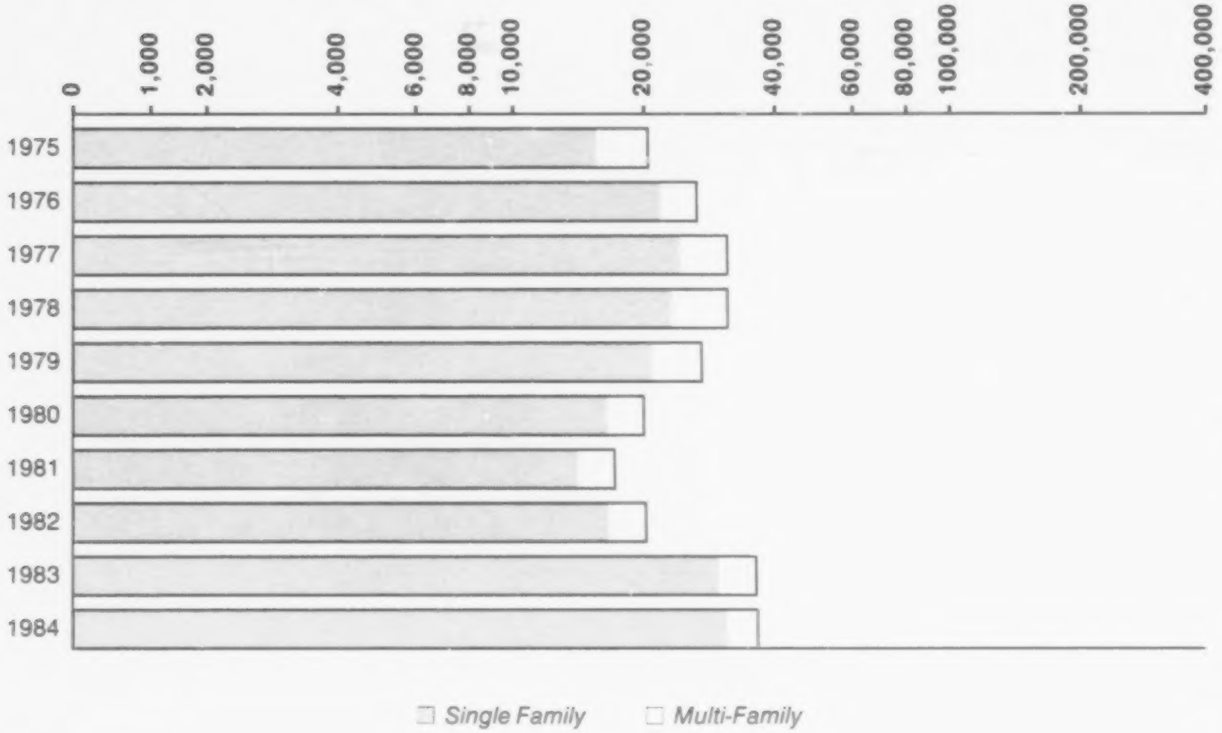
If you need refrigeration oils or information on where to get them, write to: Sonneborn Division, Witco Corporation, 520 Madison Avenue, New York, NY 10022-4236. Or call 212-605-3912.

Witco

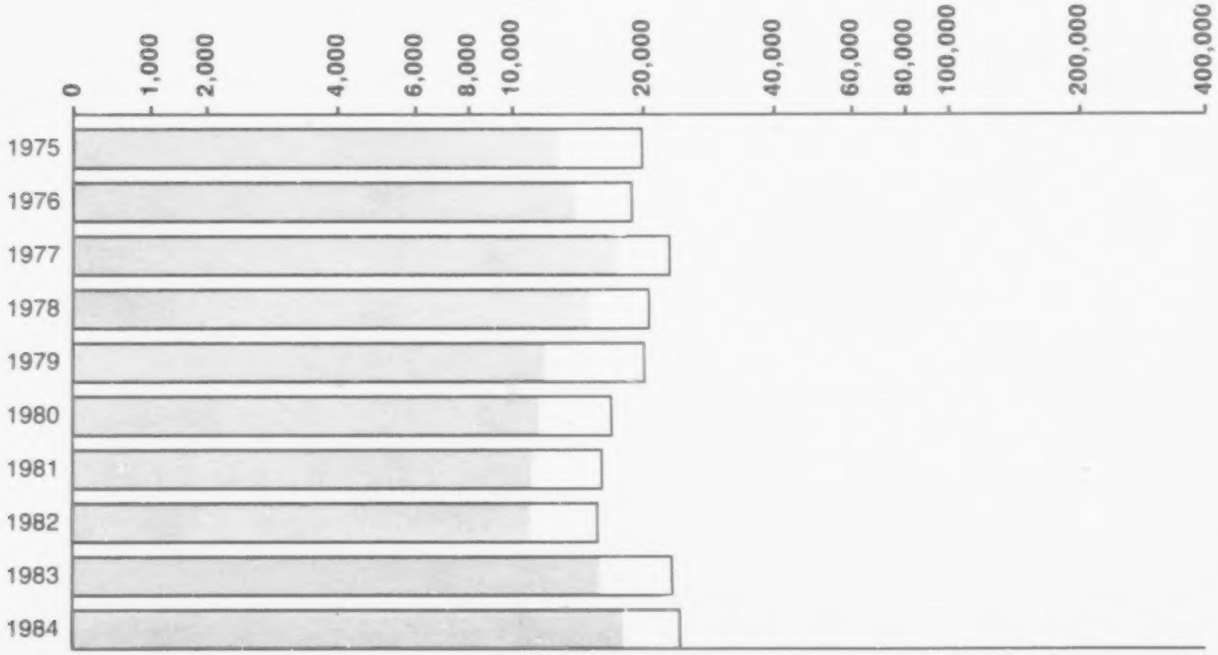
Circle 69

MARYLAND-MASSACHUSETTS

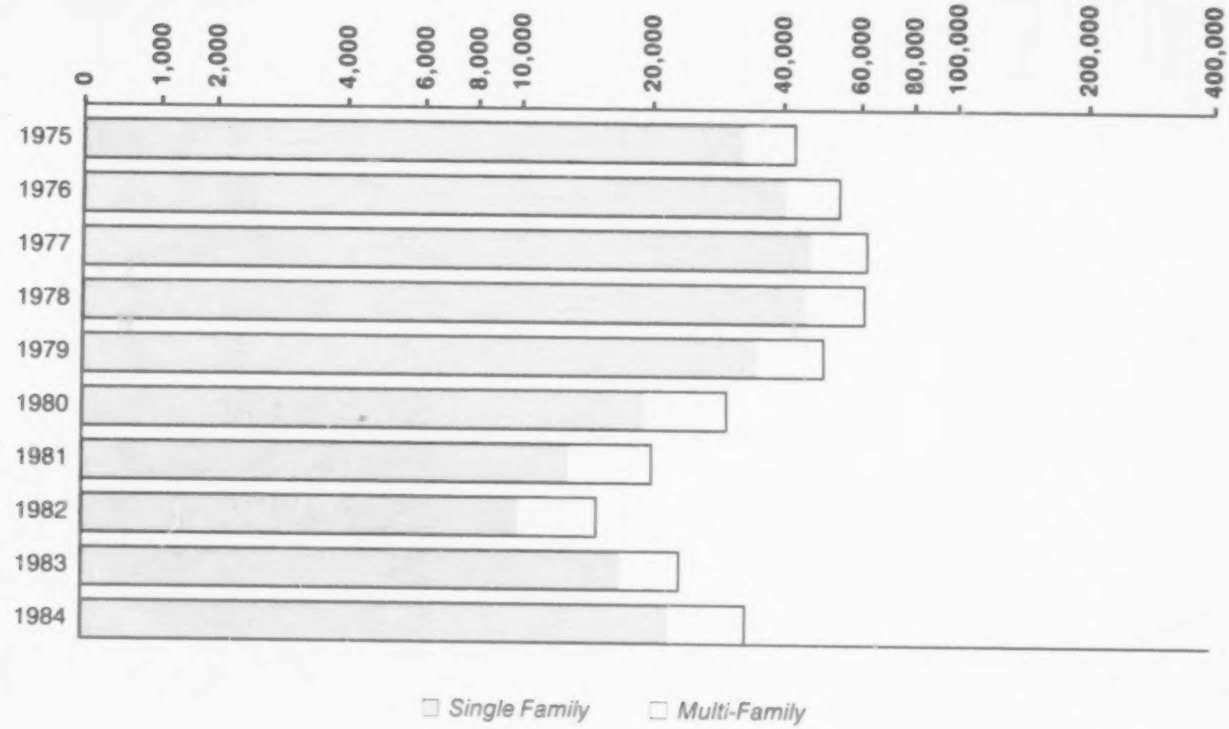
MARYLAND



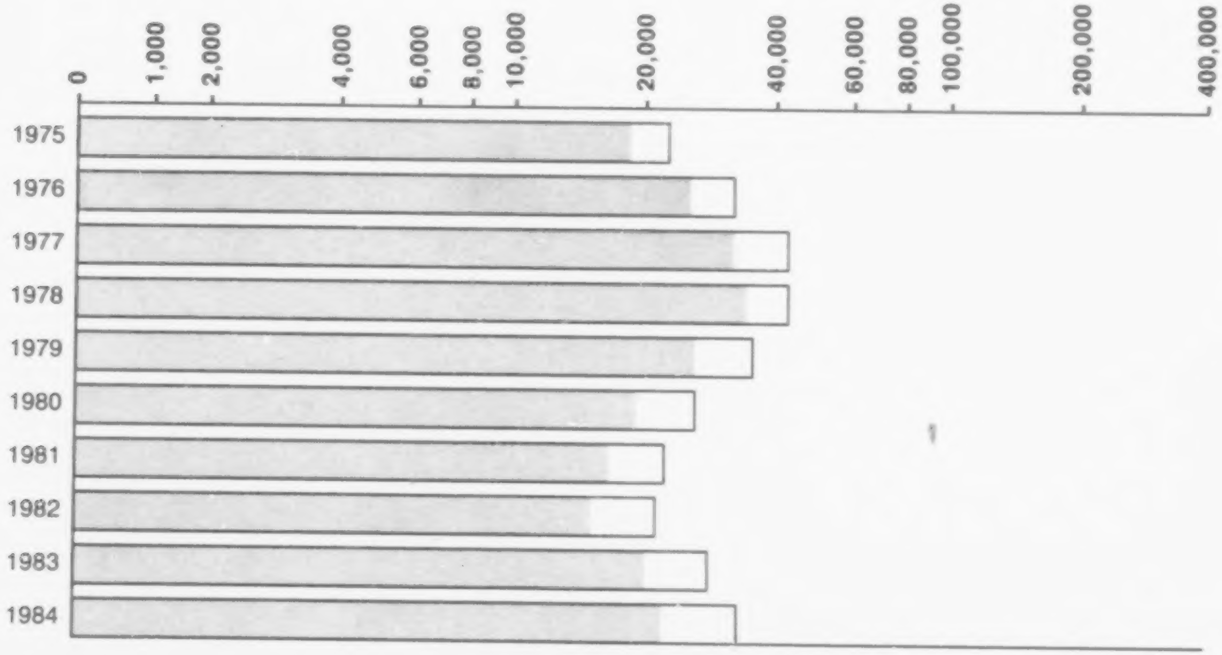
MASSACHUSETTS



MICHIGAN

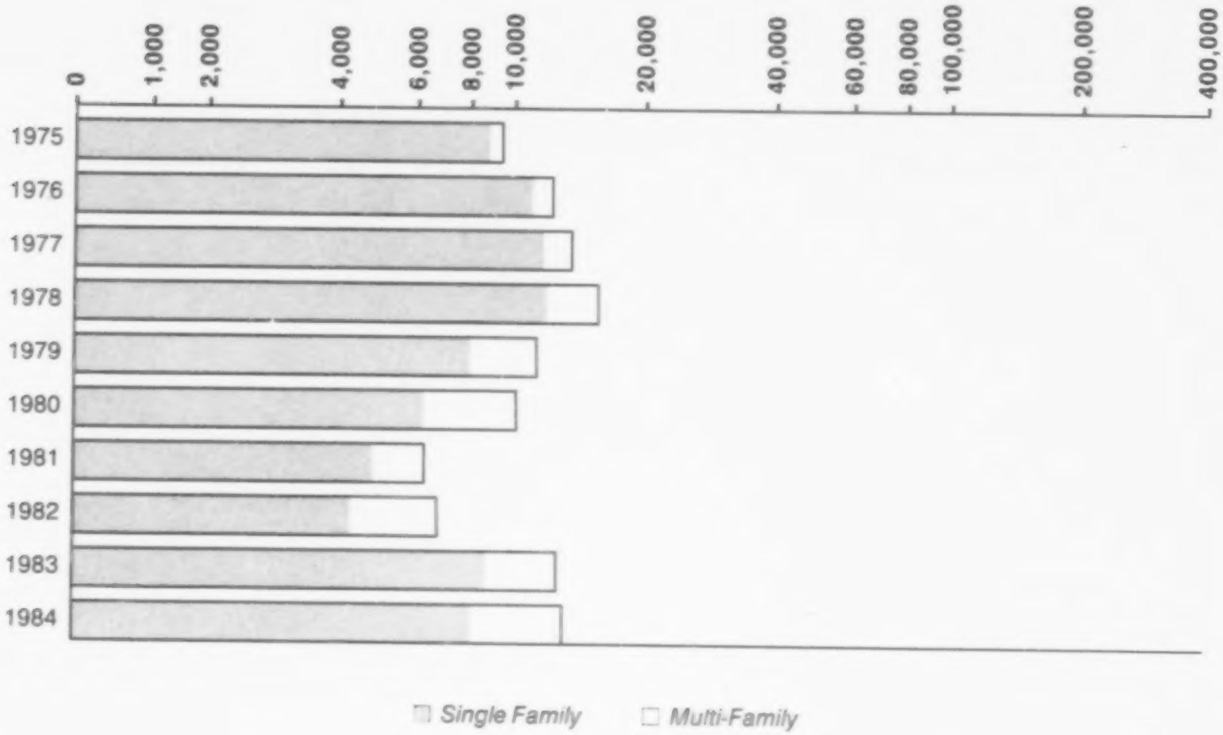


MINNESOTA



MISSISSIPPI-MISSOURI

MISSISSIPPI



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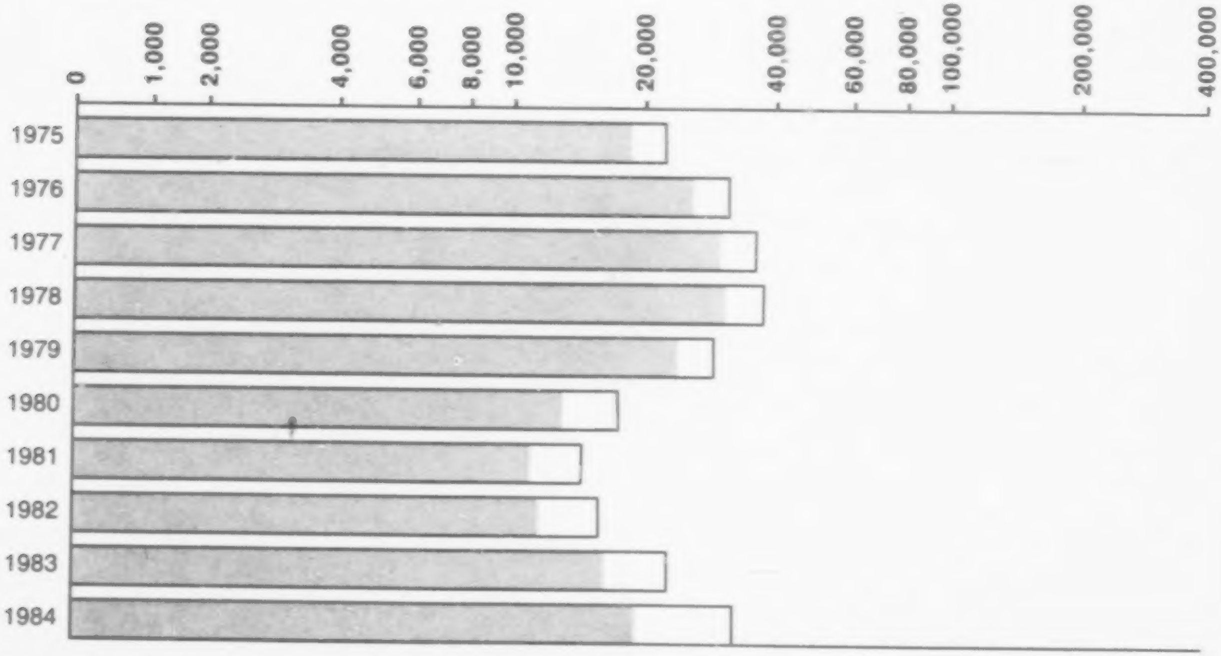
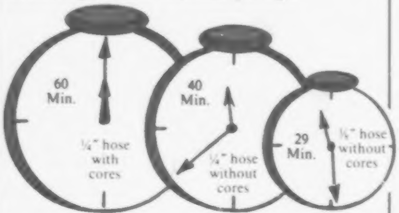


Simple Tips To Help You Cut Air Conditioning Service Time

When the "Hot Summer Service Crunch" hits, these tips and Robinair service tools can help you respond to more service calls faster, more accurately, and more efficiently. Here's how:

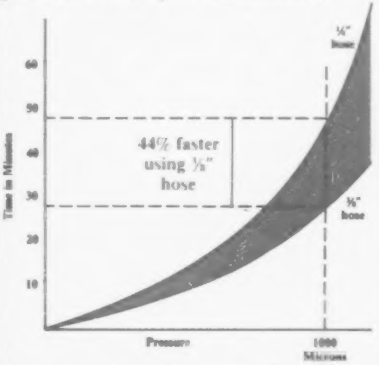
Remove the Core Restriction.
The valve cores in system access fittings drastically restrict the flow in and out of the system during both evacuation and recharging. Simply removing them saves valuable time and actually improves the efficiency of the vacuum pump.



Evacuation tests alone showed a time saving of 30% with ¼" hoses and 53% with ⅜" hoses when valve cores were removed compared to ¼" hoses with valve cores in place.

You can save time by using this valve core remover/installer. It simply attaches to the fitting and unscrews the core. The top valve closes off the system, retaining the charge and avoiding contamination while the core is removed. Simply evacuate and recharge through the tool, then valve off the system, and reinstall the core. Quick and simple.

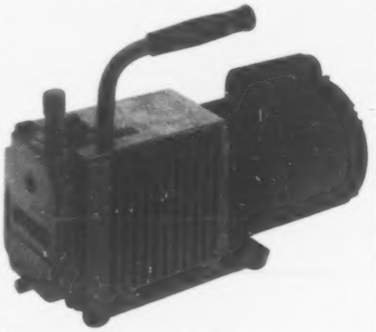
Evacuate With a ⅜" Hose.
Studies ran comparing vacuum pull down time using a ¼" hose versus a ⅜" hose revealed that the larger hose reduced pull down time by as much as 44%.



You can take advantage of this time savings with Robinair manifolds because they're built with ⅜" center ports. Our model number 40197 comes complete with ⅜" fitting and center hose. Our other models have ¼ fittings and hoses to meet popular demand, but are actually built with a ⅜" center port to easily adapt to ⅜" hoses.

Use Robinair Vacuum Pumps.
The key to fast, thorough evacuation is the quality of the vacuum pump.

A powerful, quality built vacuum pump is what makes all of these other time savers possible. And Robinair vacuum pumps are the best you can buy.



You can rely on our vacuum pumps to consistently perform to their rated CFM and micron level capability. We offer three sizes, to help you select a pump to match your specific needs. And the 15101-B and 15102-B have new increased CFM capabilities, making them faster than ever.

Avoid Overkill.
The most common time waster in typical evacuation procedures is overkill. Simply letting the pump run for a specified time, beyond what is required for thorough evacuation, instead of monitoring the vacuum and completing the procedure as soon as the system is dehydrated.

Our Thermistor Vacuum Gauge measures using the micron scale, precisely indicating the vacuum level reached, so you can stop evacuating when the system's clean. It's also a sensitive leak detector, and even shows you whether moisture and contaminants remain in the system, requiring more pull down time. It's an invaluable instrument for measuring the thoroughness of an evacuation, and for saving time.

Recharge With Positive Pressure.
Dial-A-Charge charging cylinders help you cut service time in two ways. First they meter the amount of refrigerant you add, eliminating the possibility of over or under charging. Secondly, they're equipped with heaters to increase the pressure inside the cylinder, creating positive pressure and forcing a fast and complete refrigerant transfer. And they're light-weight and portable, too, so you don't have to carry a bulky 30 pound drum just to charge 5 or 6 pounds of refrigerant.

Buy Robinair Service Tools.
Rely on Robinair for all of your air conditioning and refrigeration service tools and equipment. For more helpful information on service tools and procedures ask your wholesaler about our video training series "Keeping It Cool".

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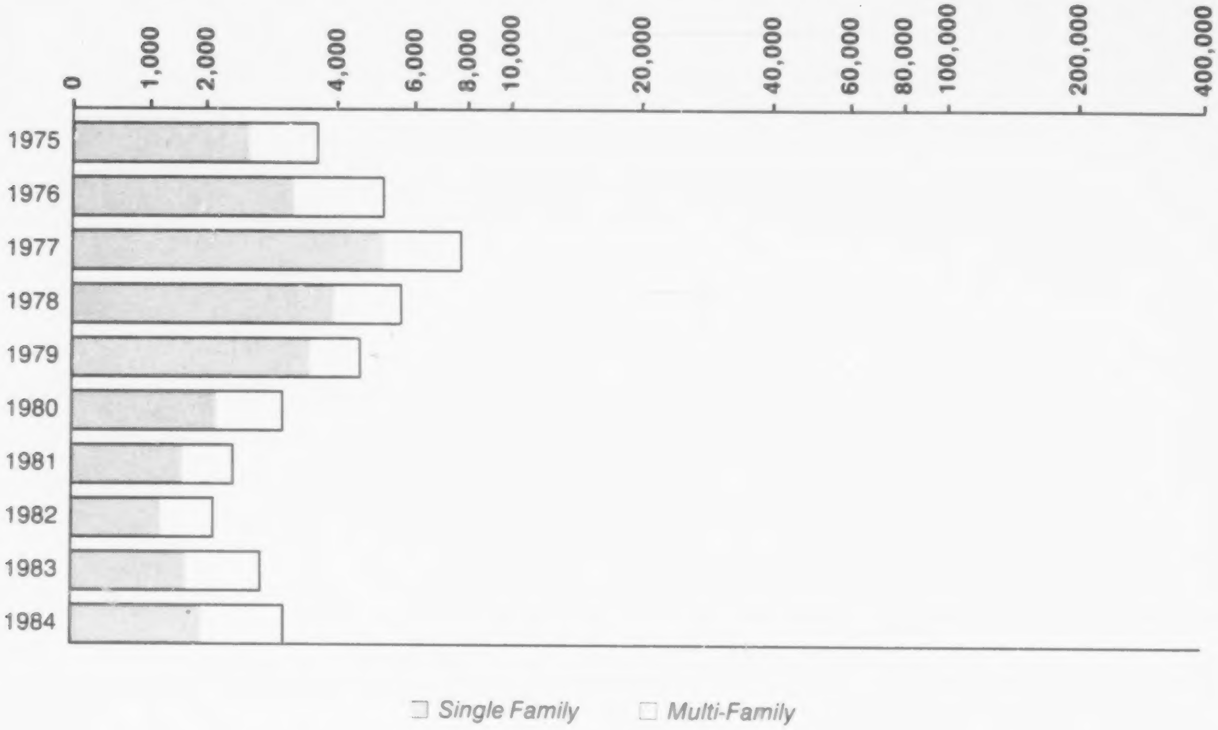
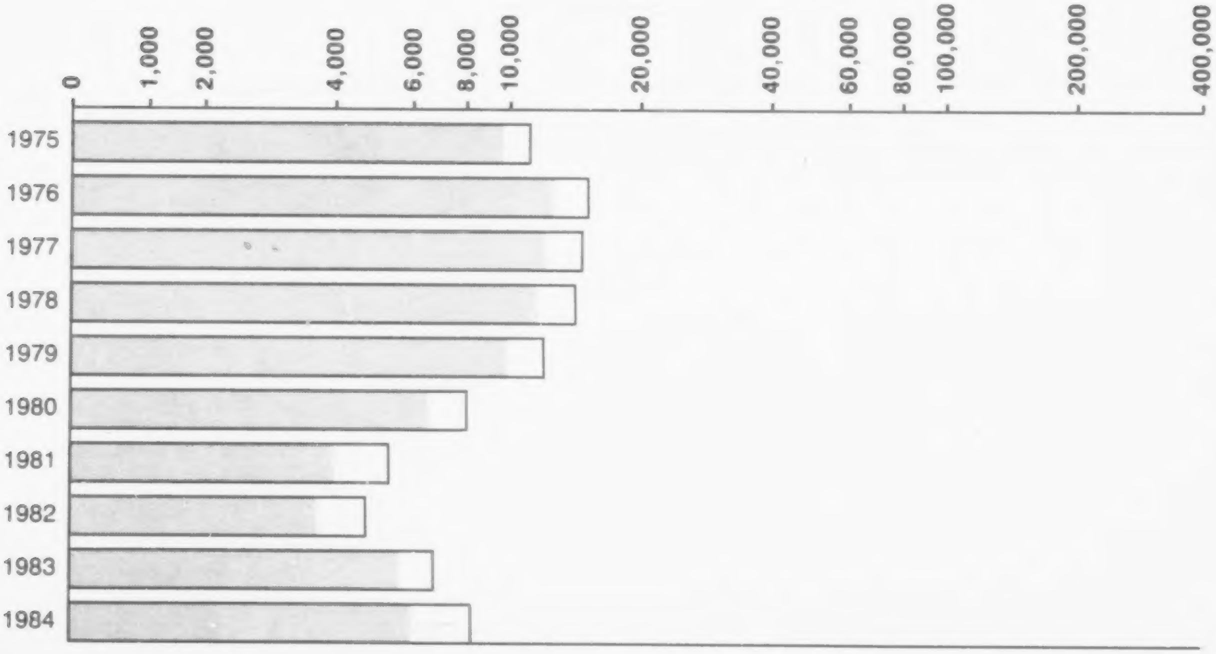
Circle 43

MONTANA-NEBRASKA

MONTANA

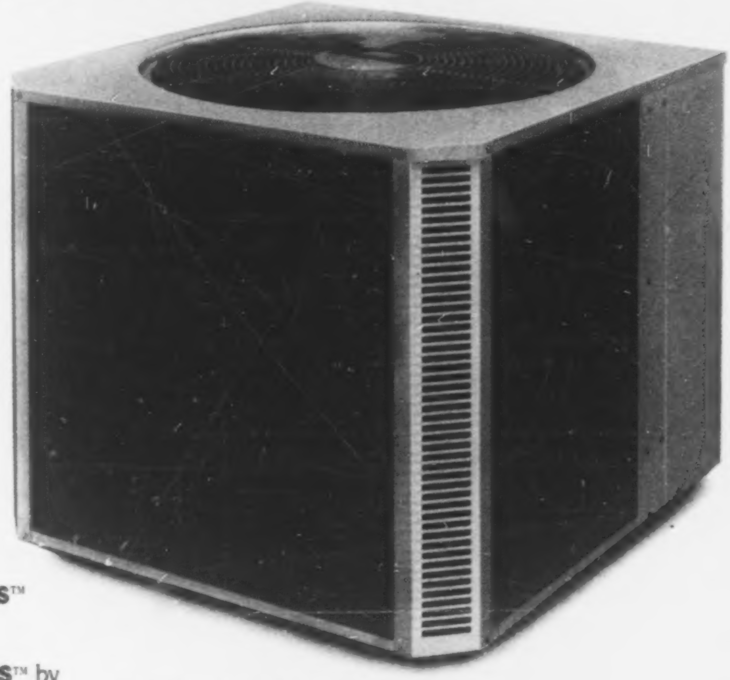


NEBRASKA



The **TEN-PLUS**.™ New from Bard—

The air conditioner that makes the competition sweat.



For some, building an air conditioner with a 10 SEER rating is an end in itself. For Bard, a 10 SEER rating, though impressive, is just the beginning. Take our latest idea, the **TEN-PLUS**™ high efficiency air conditioner.

We've maximized the energy efficiency of the **TEN-PLUS**™ by adding the kind of features that the cost conscious customer demands.

Things like an extra large condenser coil for more efficient heat transfer. A flow control valve that lets you match indoor coils to the outside unit. Standard waste heat recovery valves that facilitate installation of an optional hot-water heat exchanger. And a 24" diameter fan that quietly moves large volumes of air at lower speeds.

Bard's Efficiency Plus Flow Control Valve
The key to energy saving flexibility.

These are just a few of the money-saving features we've built into the **TEN-PLUS**.™ And of course, the Bard name guarantees both efficiency *and* durability. For a complete run-down of specifications and details, contact our National Sales Manager, Tom Williams at (419) 636-7400.

The **TEN-PLUS**™ from Bard. Available in 2, 2½, 3, 3½, 4 and 5 ton models. There's just no better way to keep cool. That's good news for your customers. And bad news for the competition. Because once again, they're feeling the heat.

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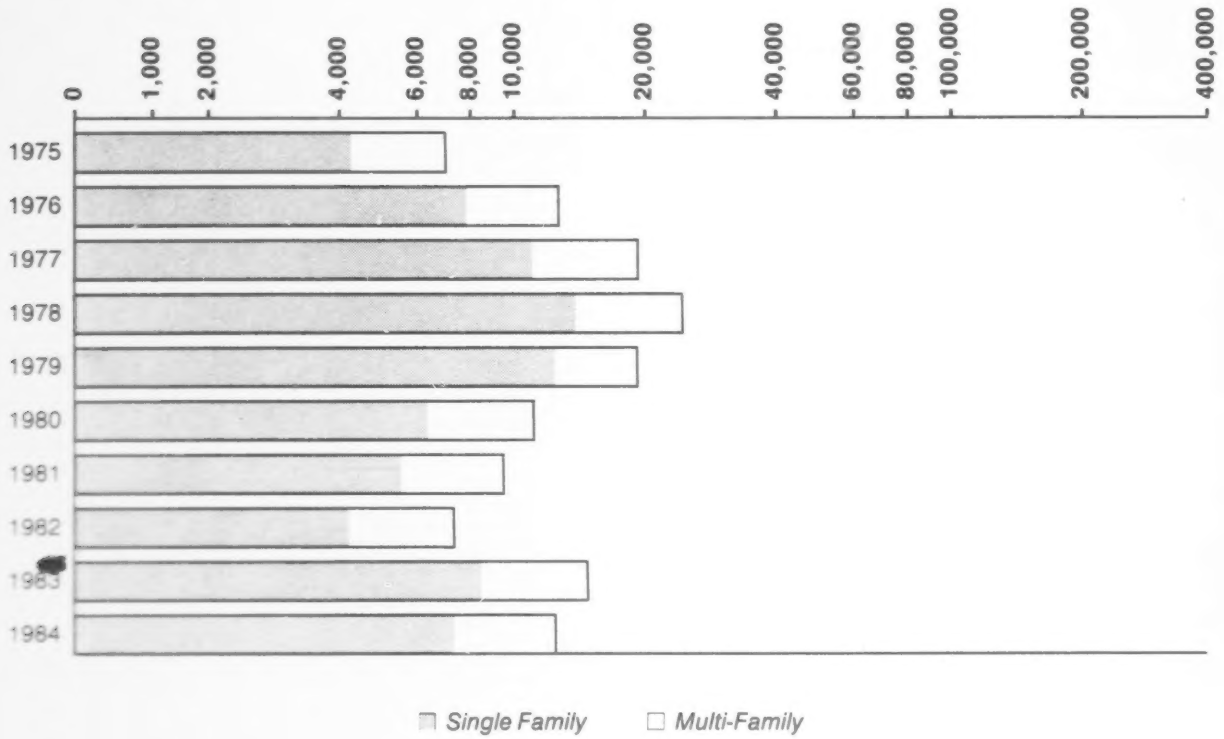
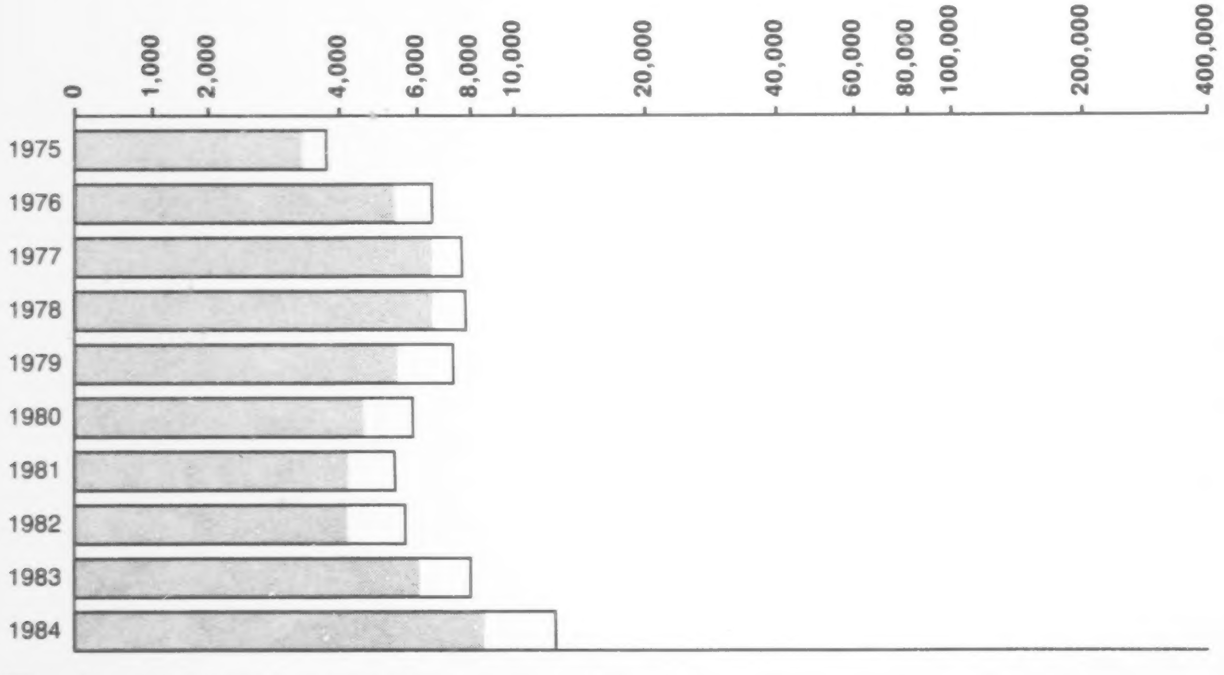


NEW HAMPSHIRE



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NEW JERSEY-NEW MEXICO

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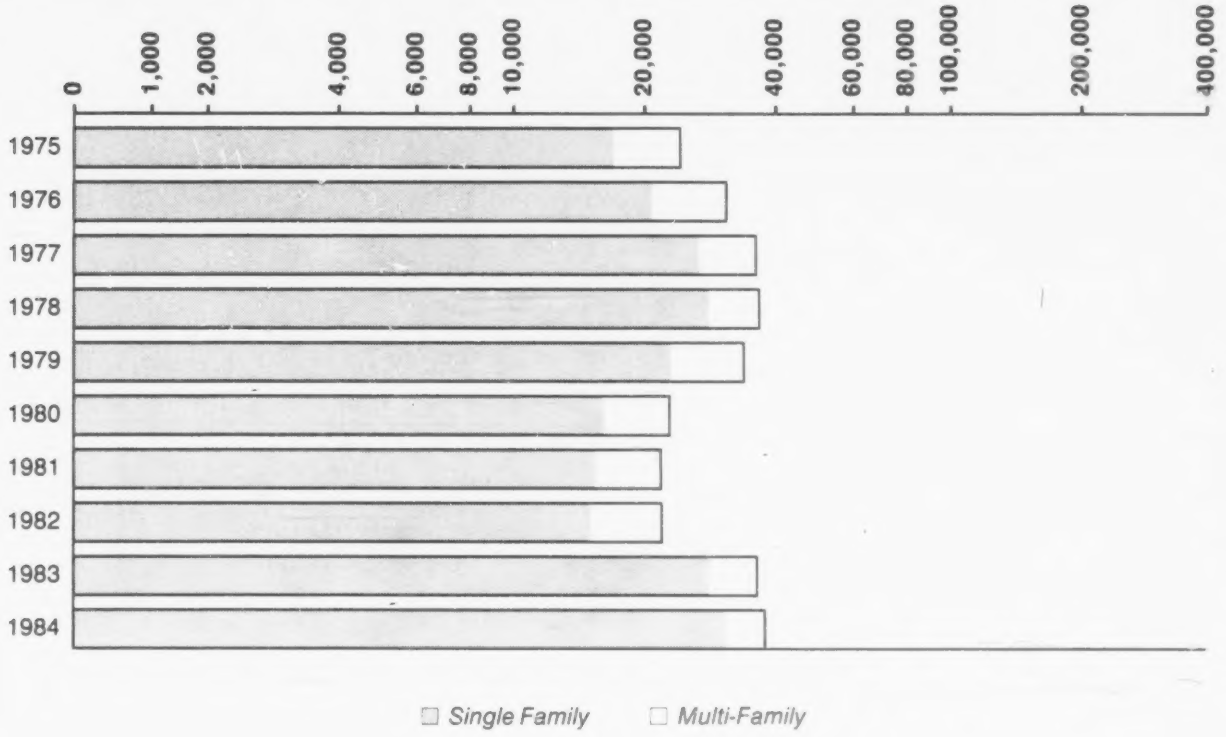

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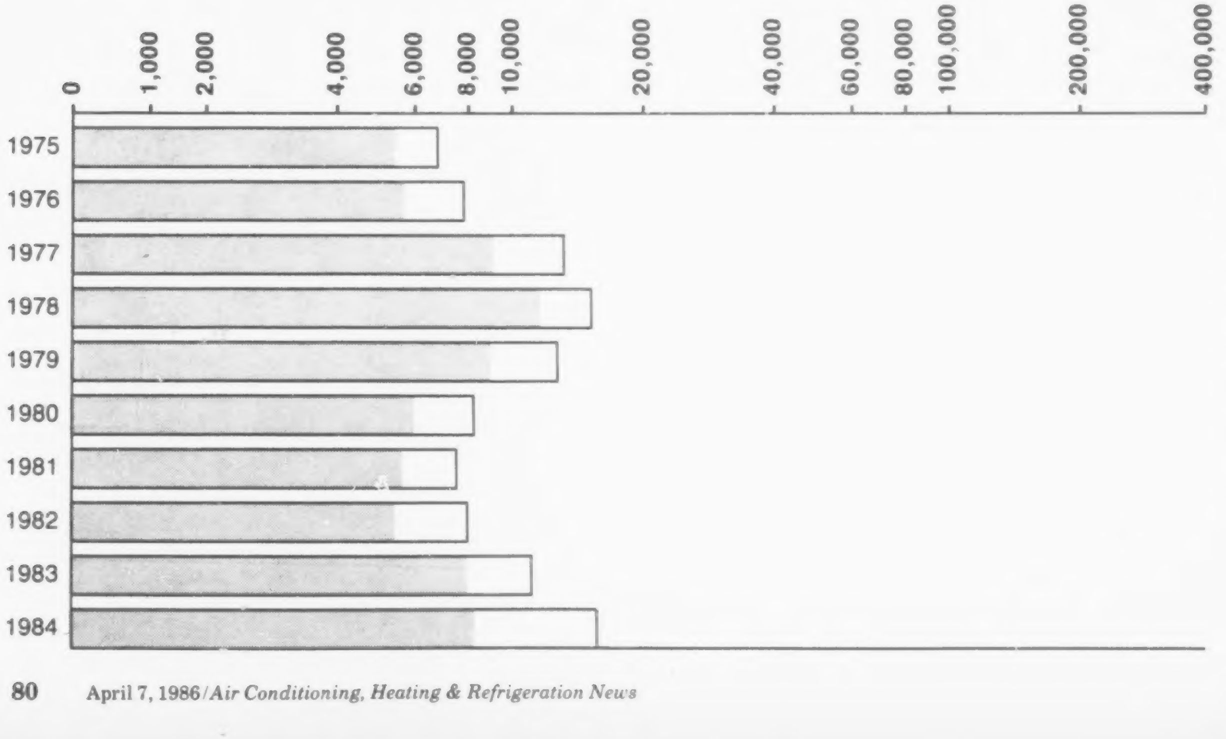

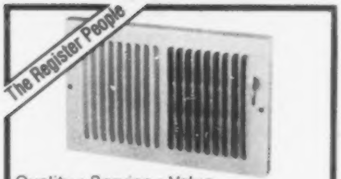

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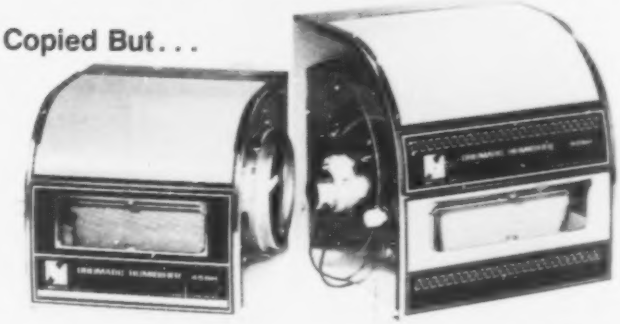

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Circle 14

NEW YORK-NORTH CAROLINA

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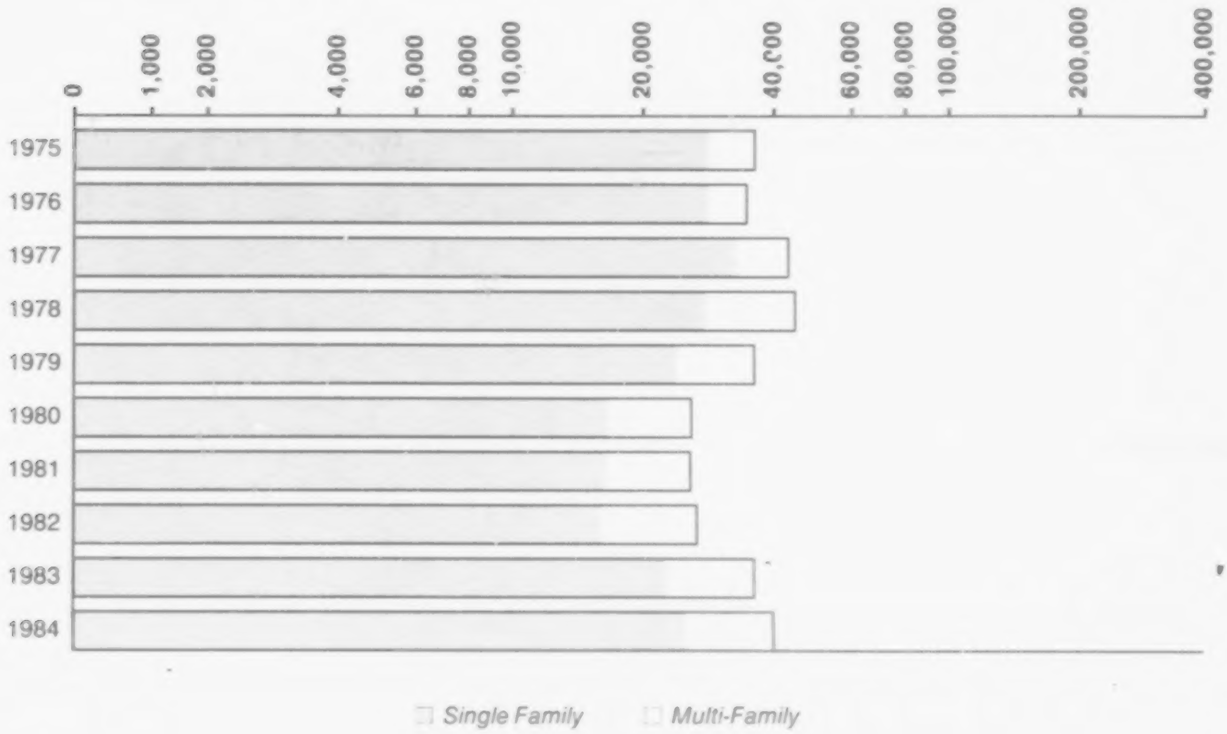
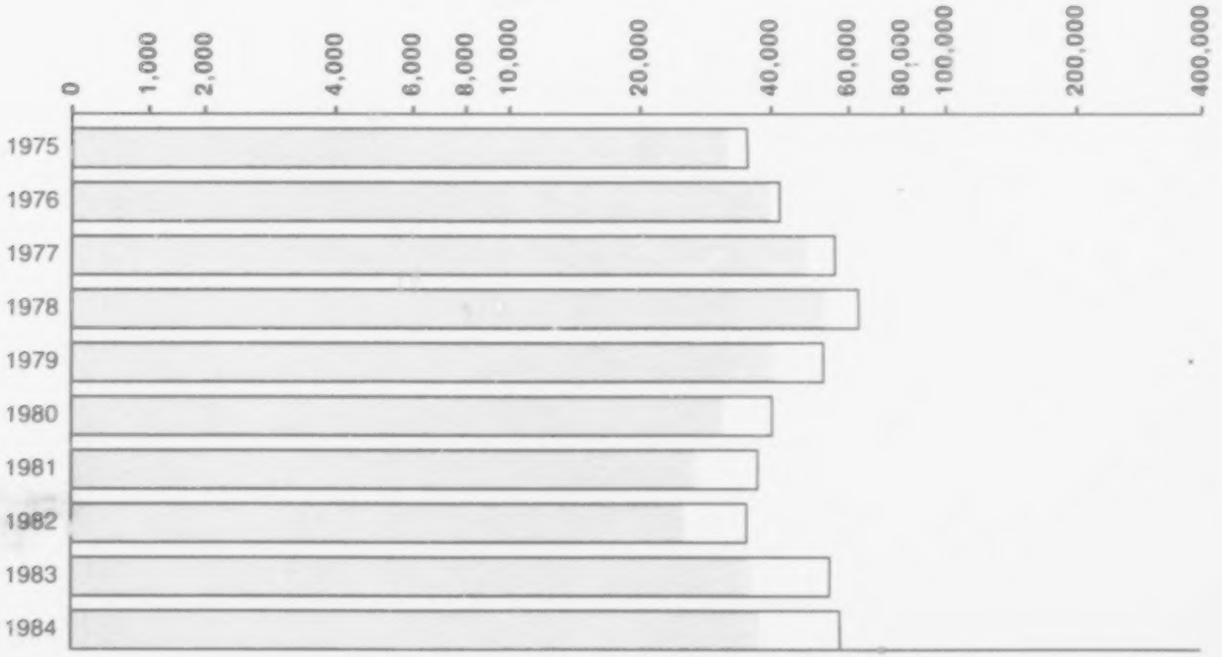


NORTH CAROLINA



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The W7505 is sold to contractors through Honeywell Authorized Systems Distributors. For the name of the authorized distributor nearest you, call us: 1-800-328-5111. Ask for Ext. 744.

Together, we can find the answers.

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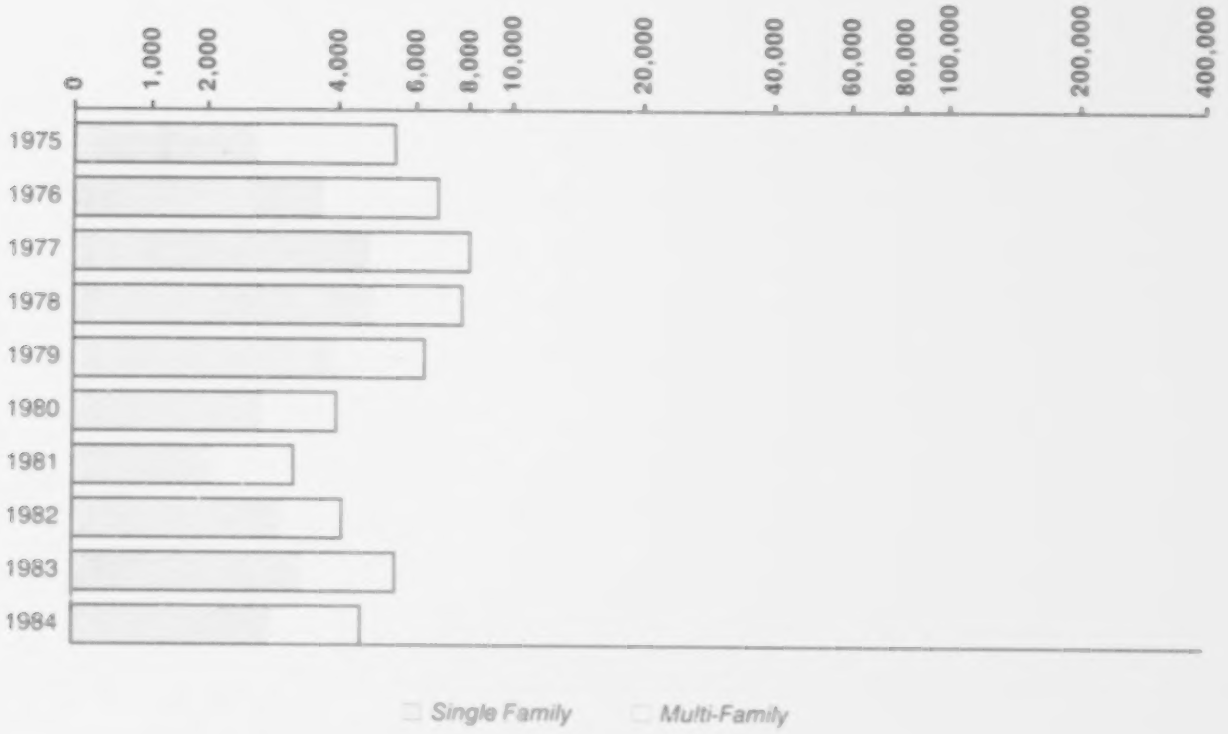
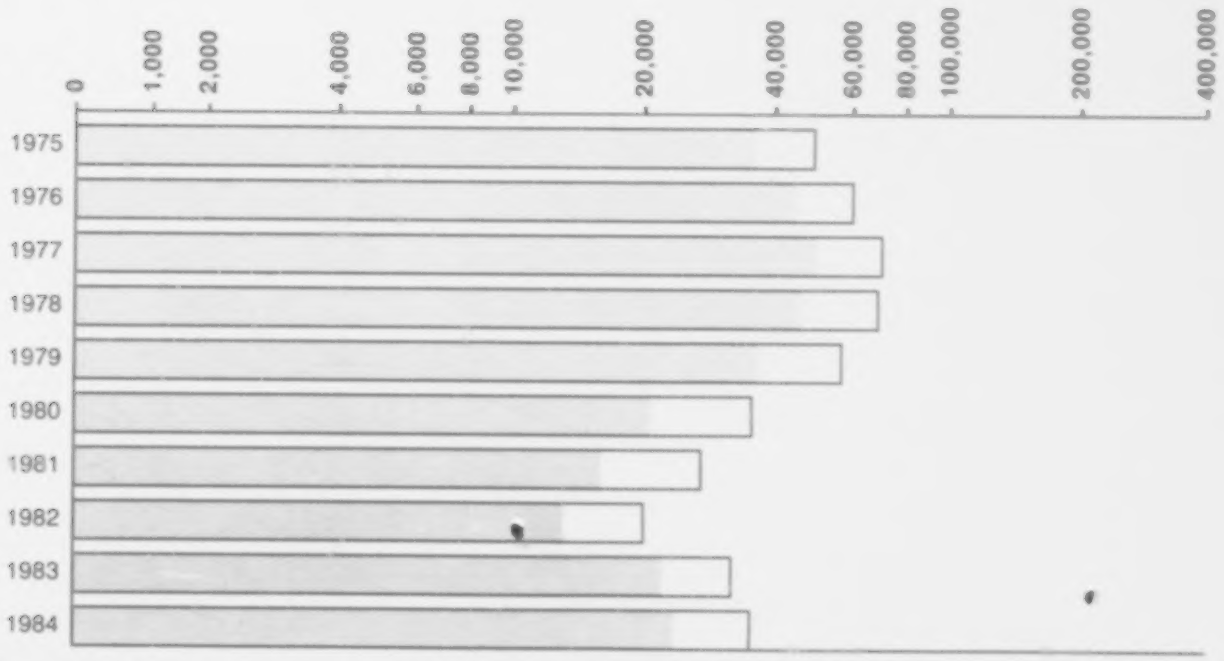
NORTH DAKOTA-OHIO

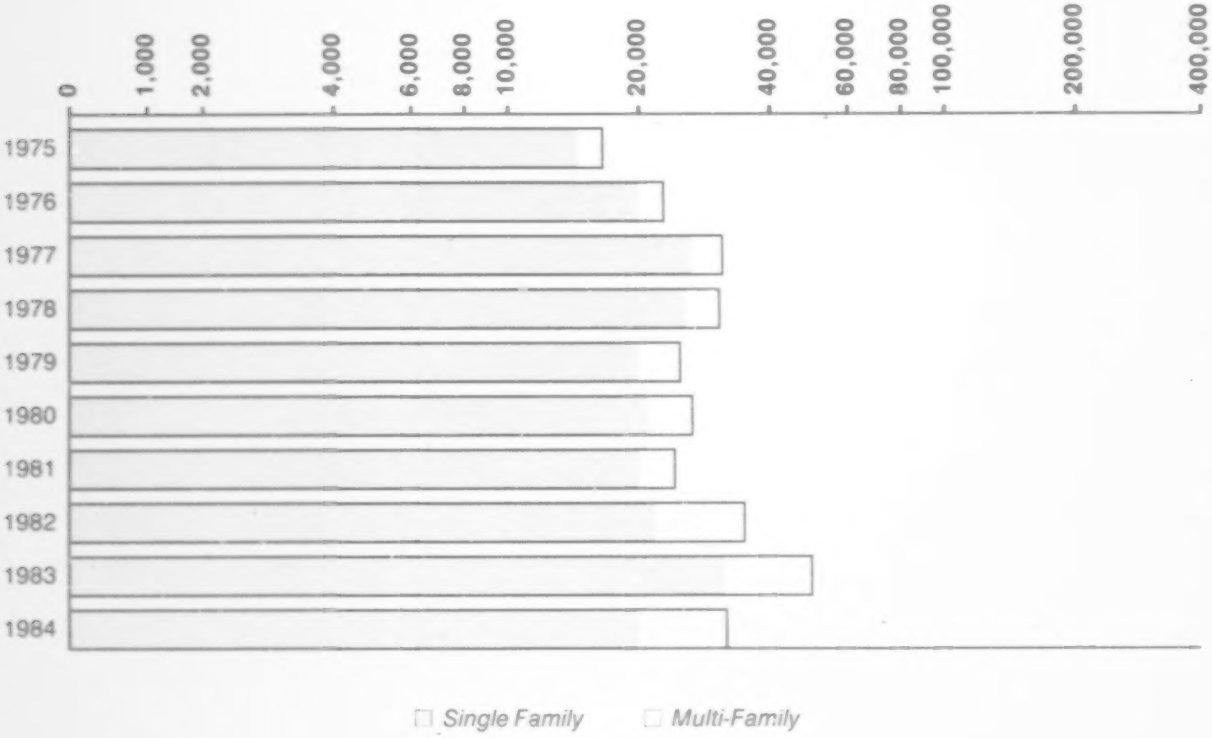
NORTH DAKOTA



OHIO



OKLAHOMA



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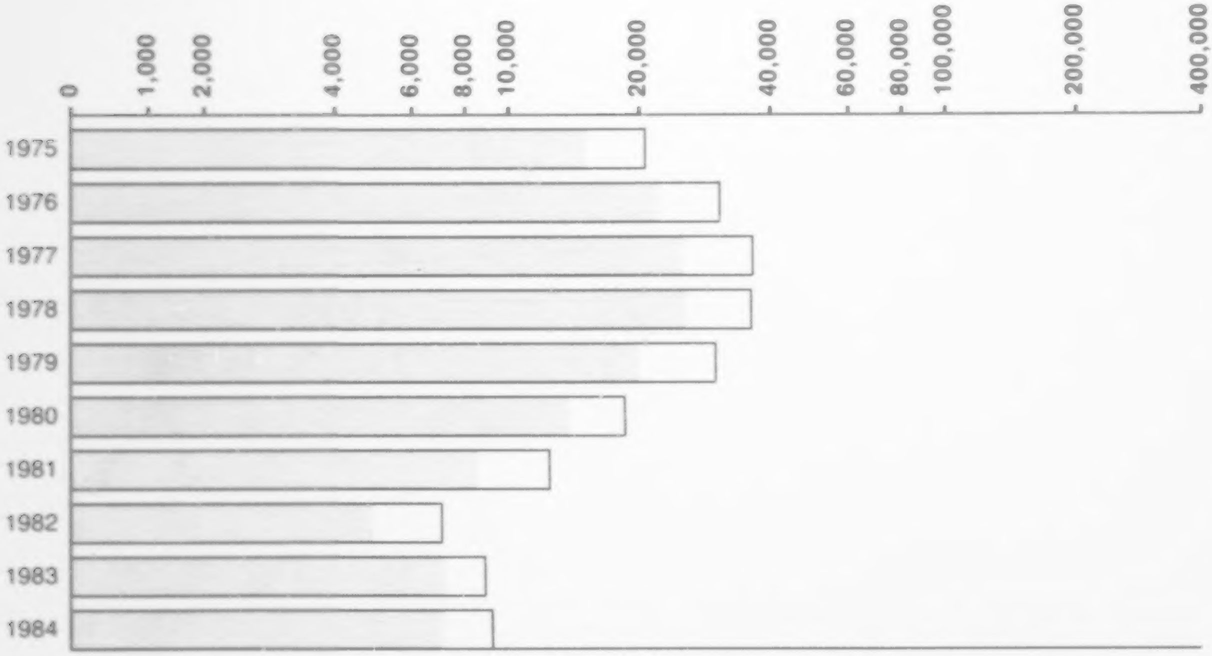

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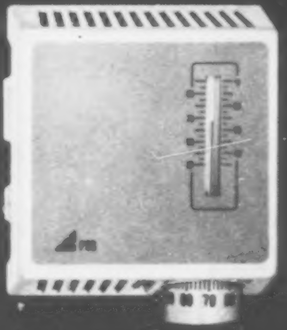

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Tools needed to install bimetals

Tools needed for T30

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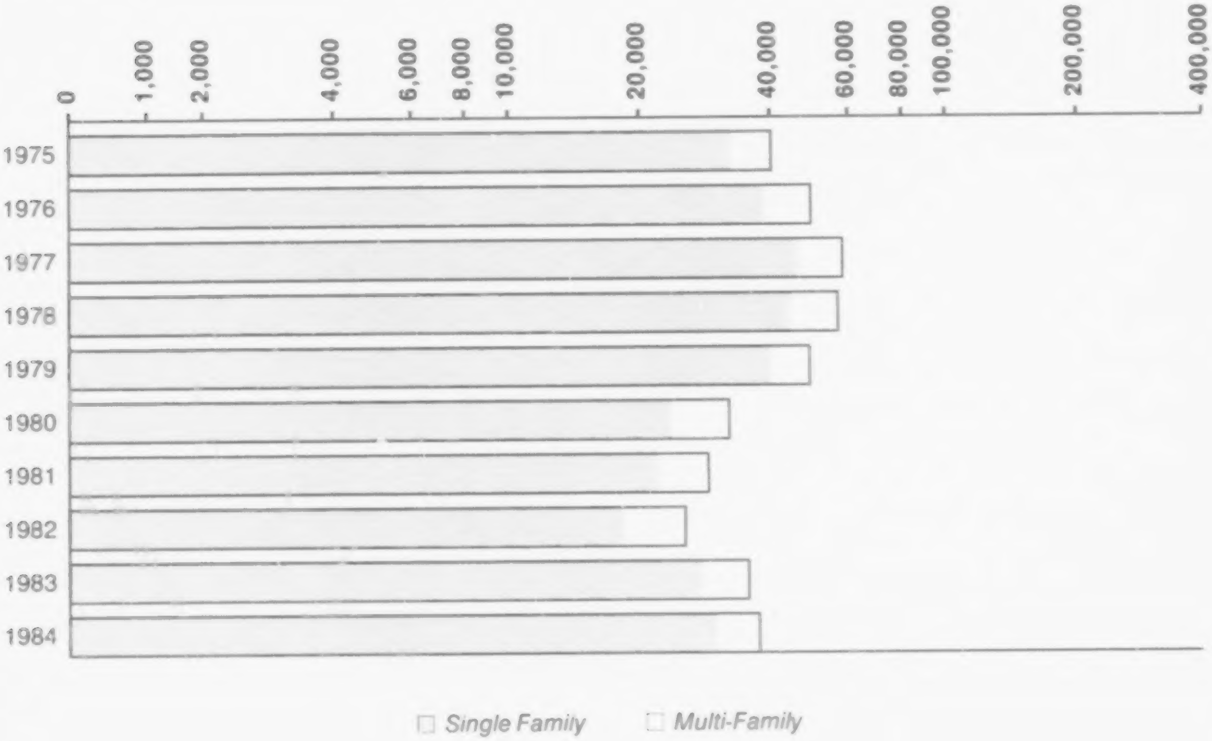

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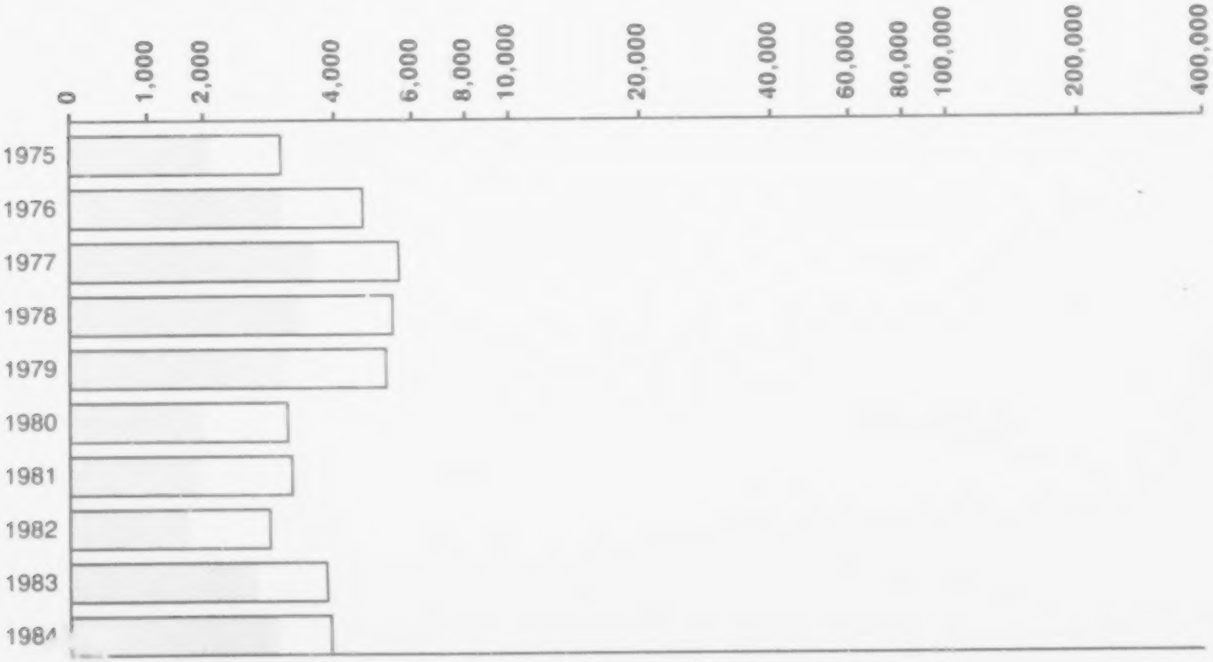
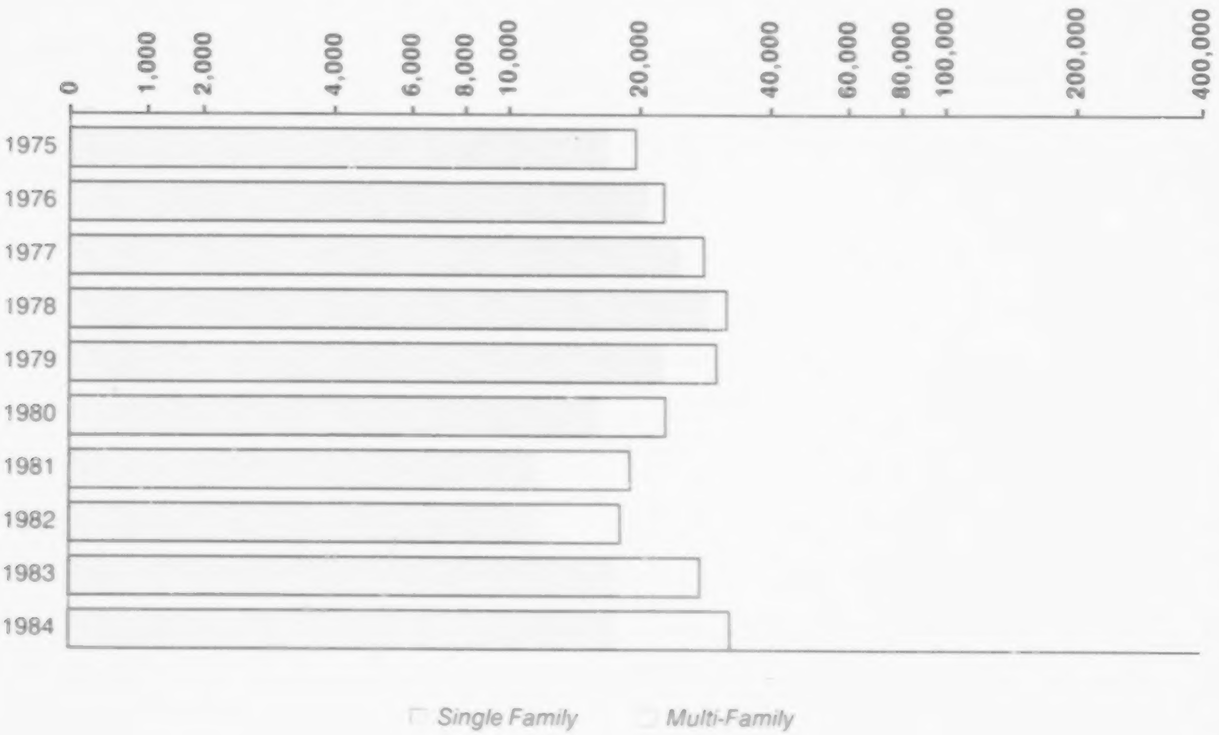


SOUTH CAROLINA-SOUTH DAKOTA

SOUTH CAROLINA



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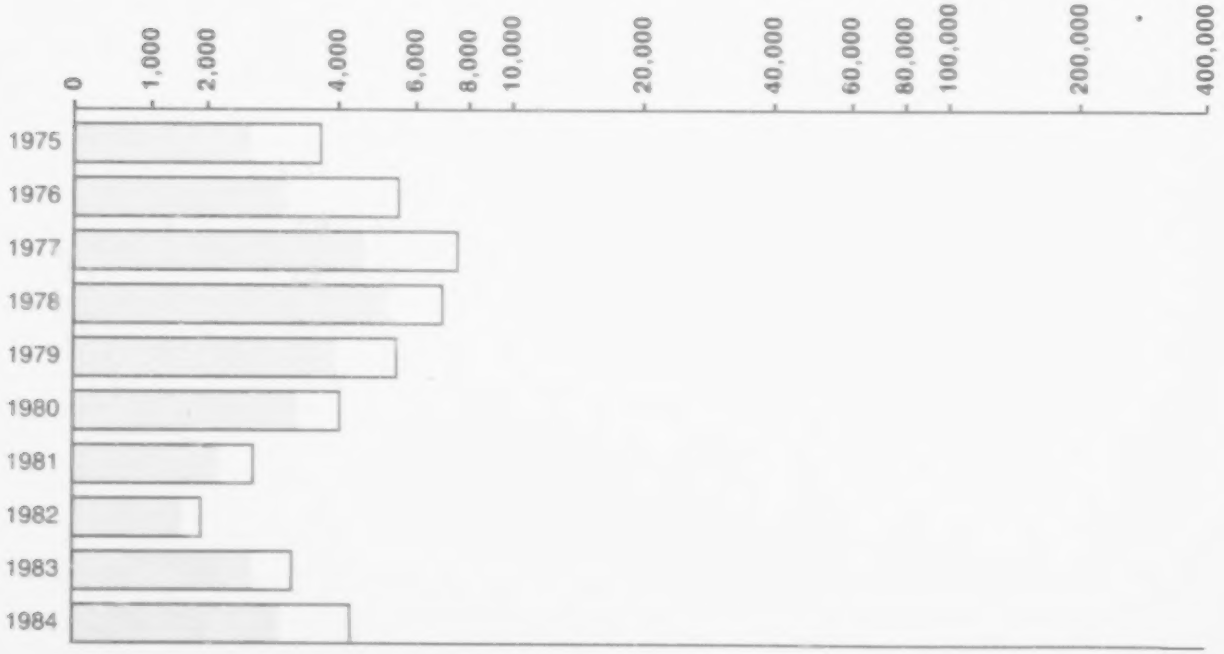

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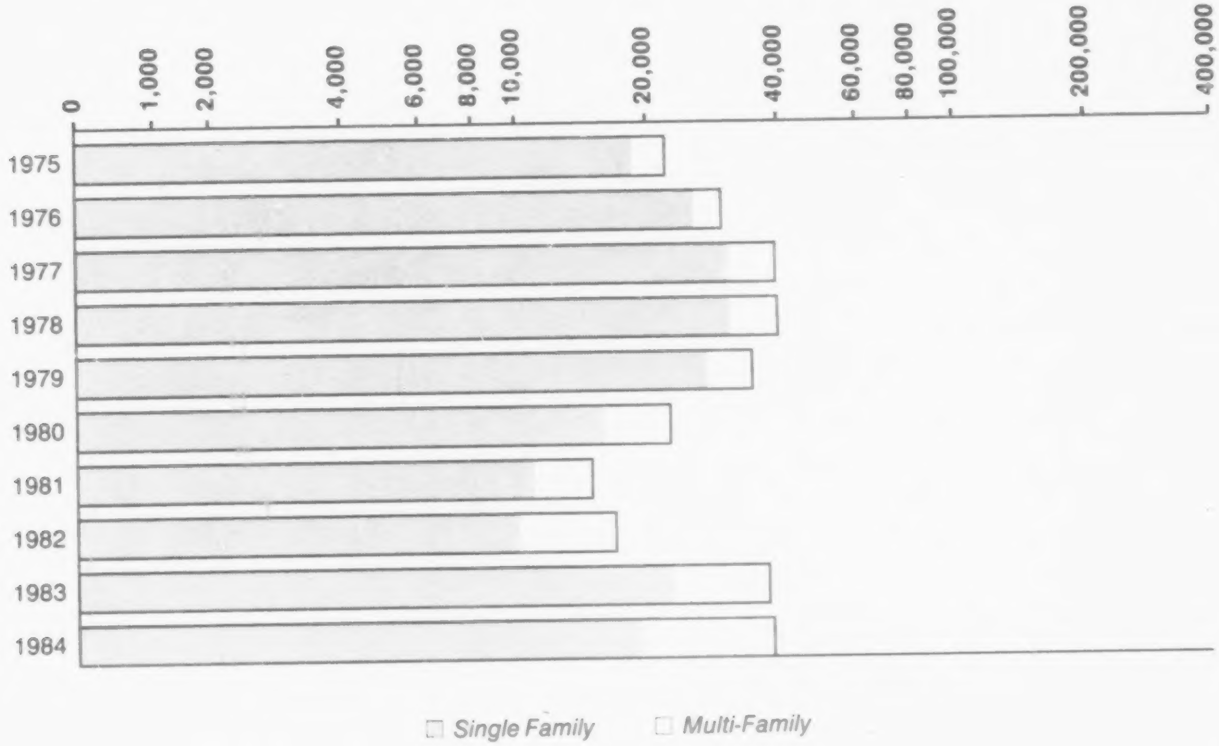

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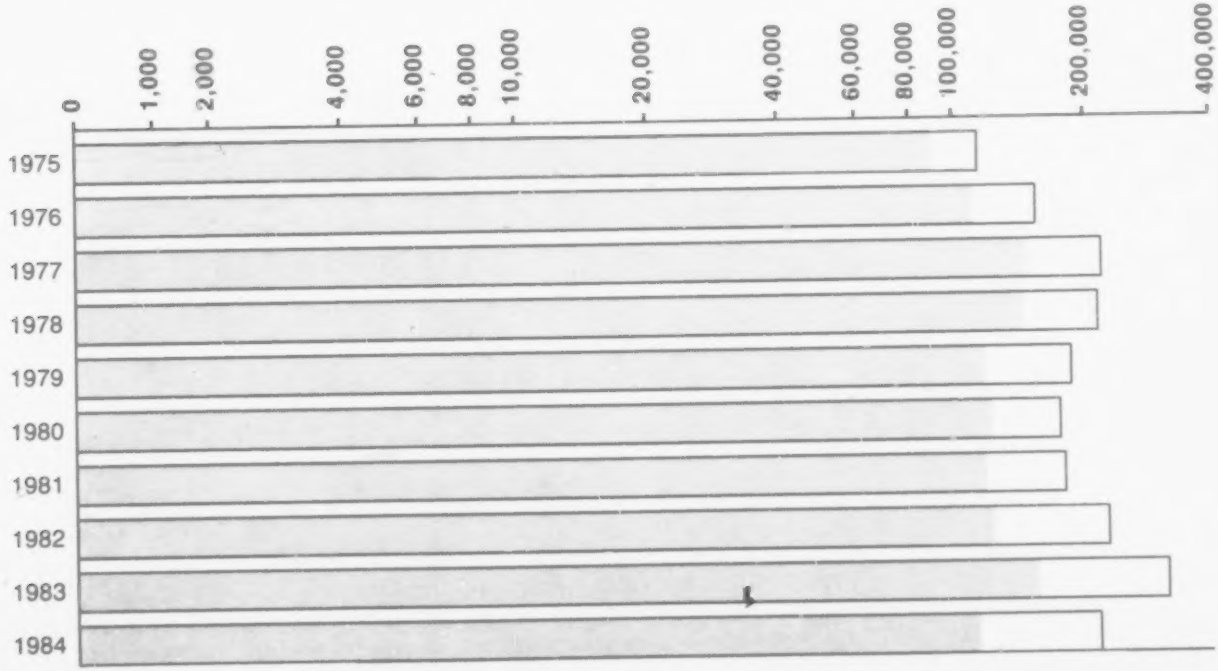

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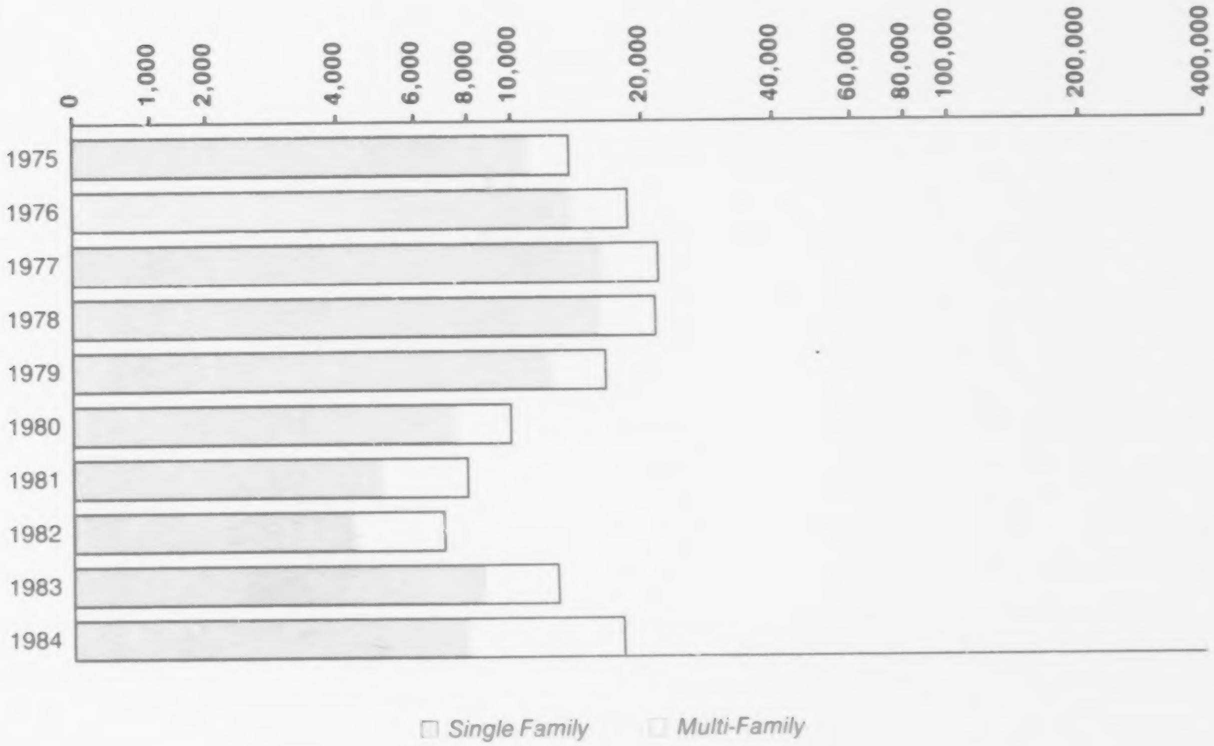

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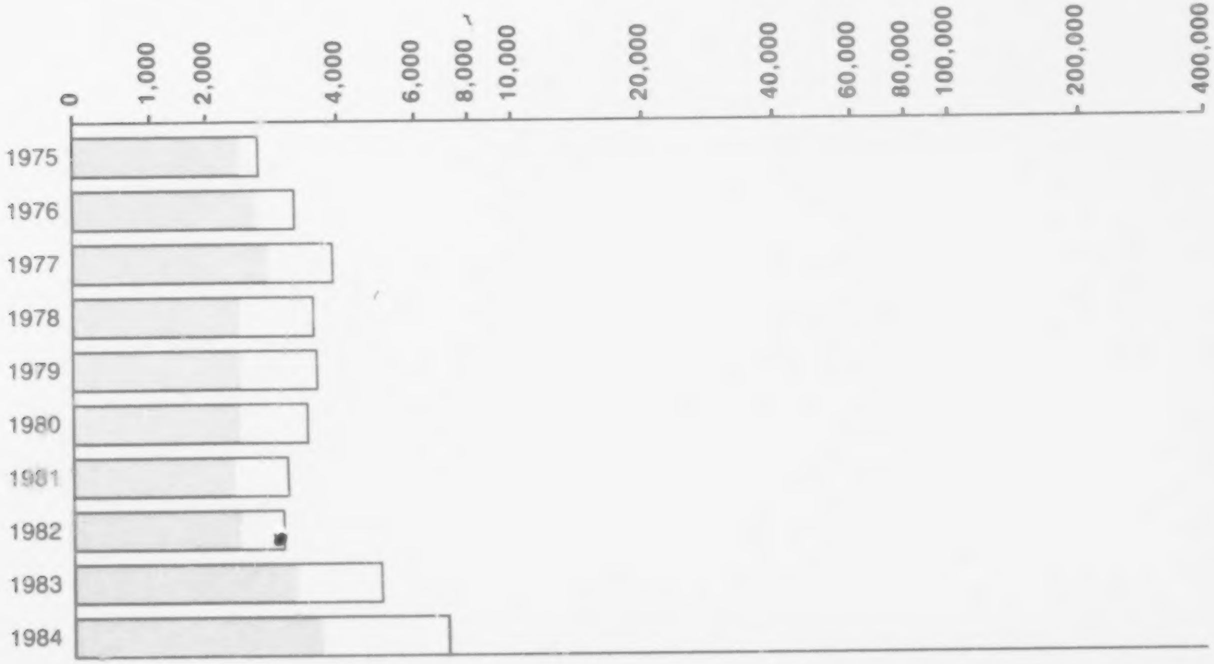
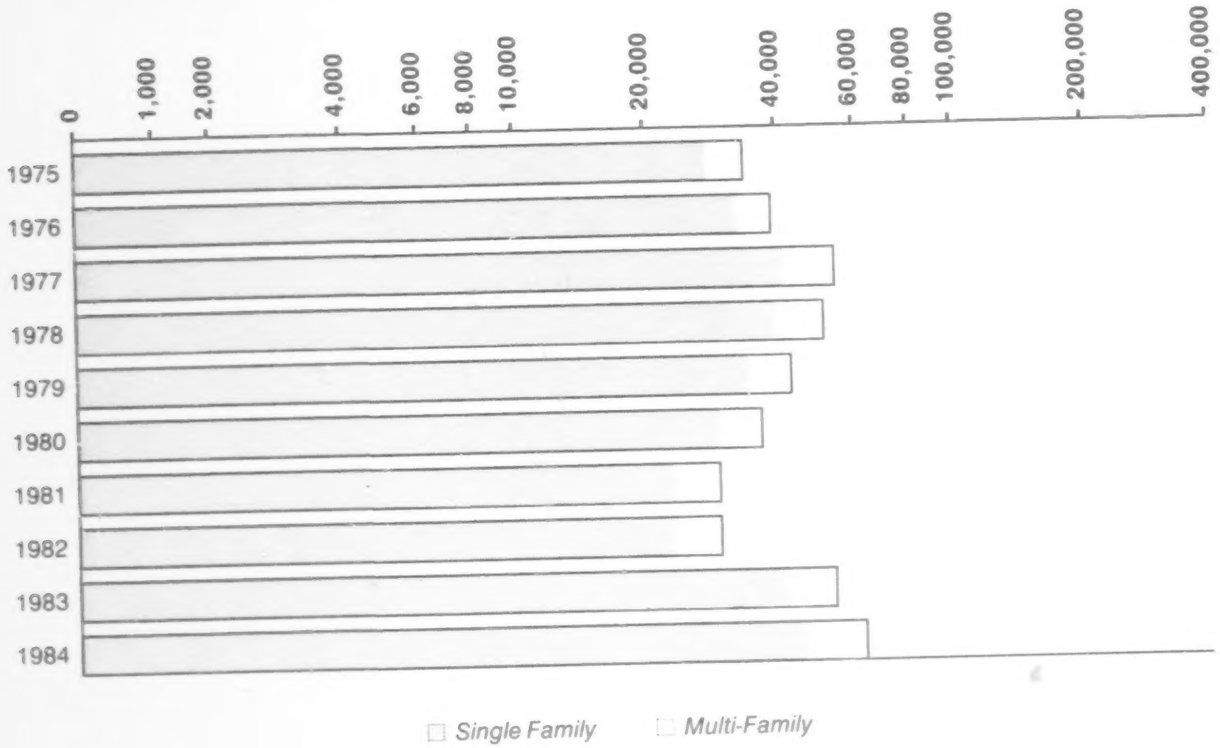


VIRGINIA-WASHINGTON

VIRGINIA



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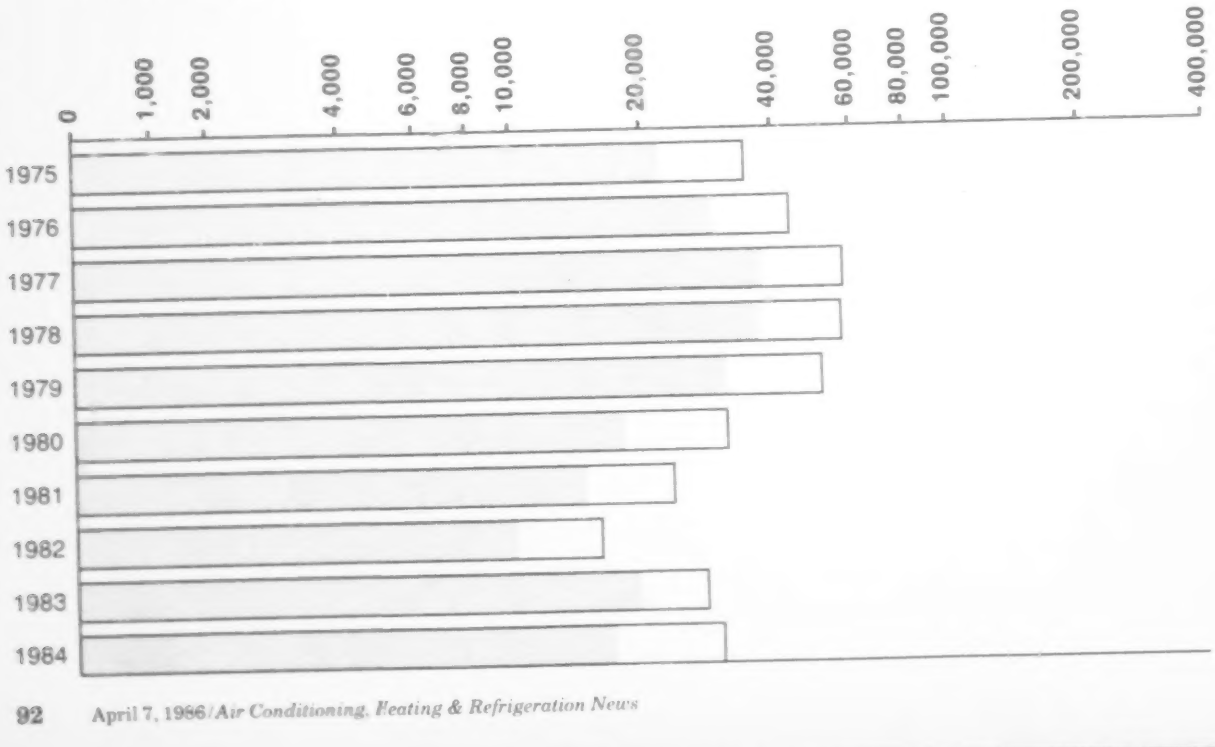

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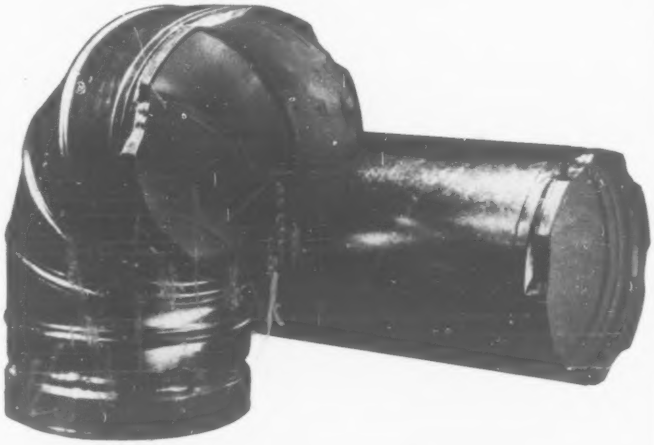

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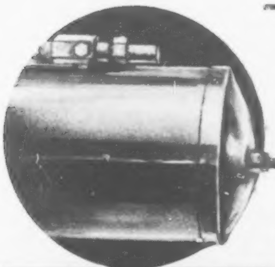

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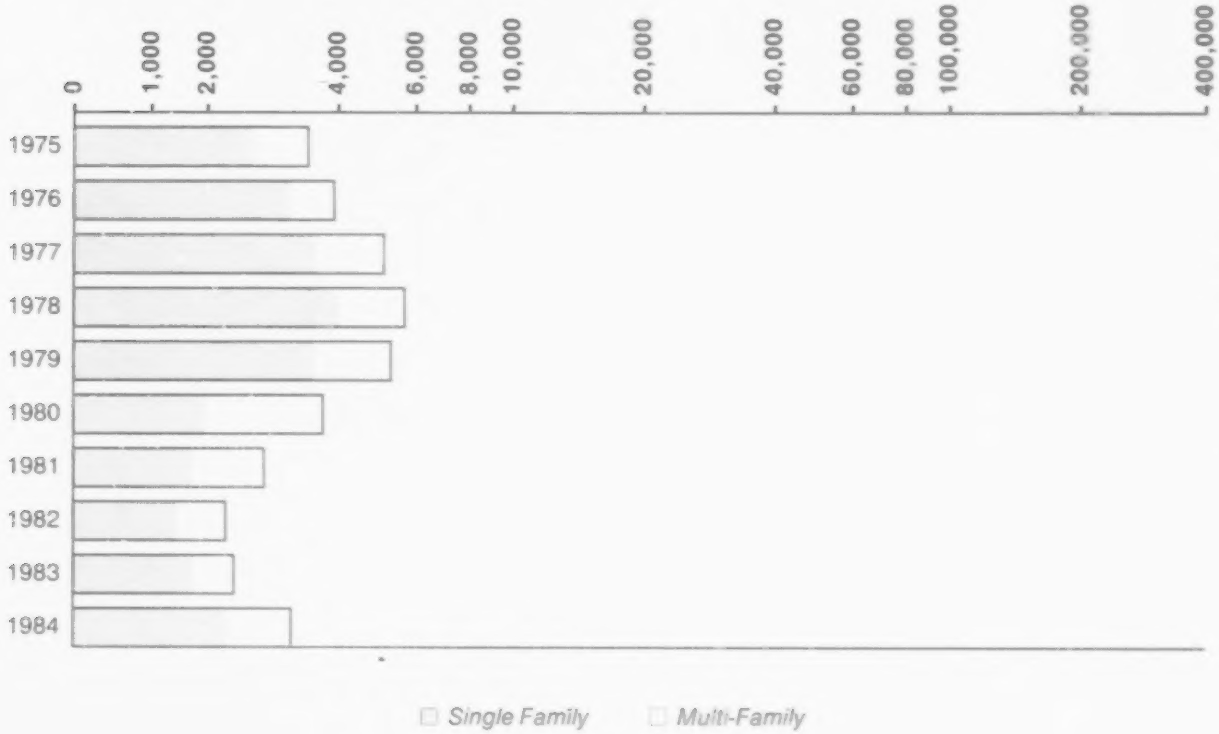

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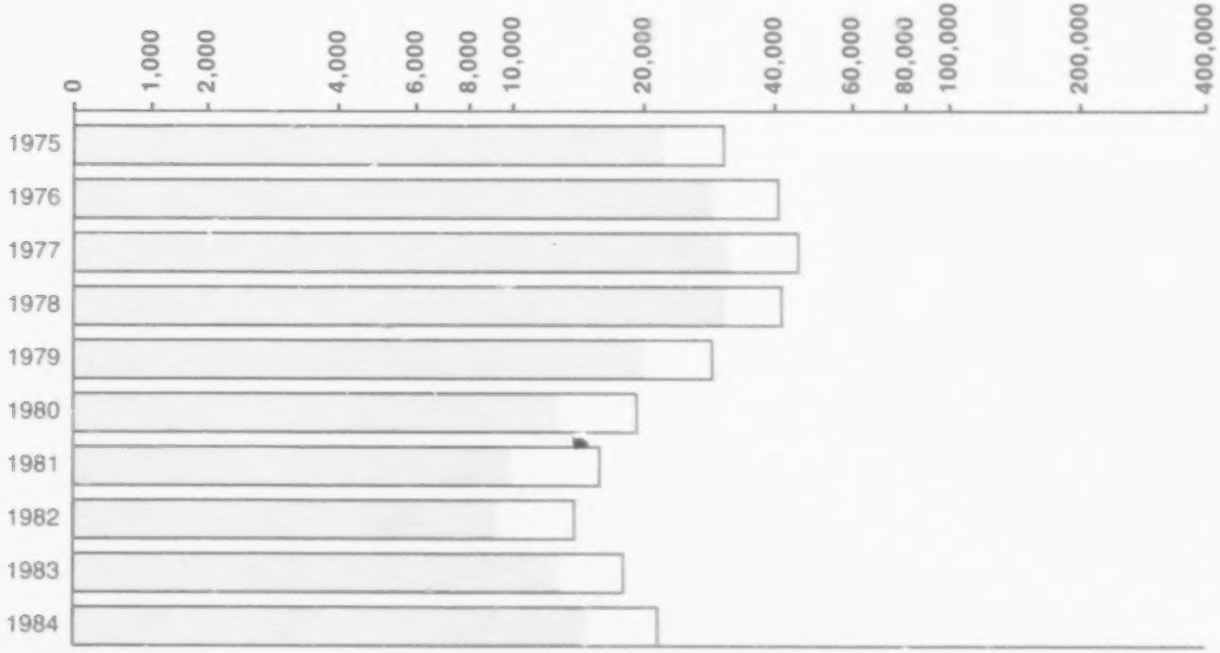

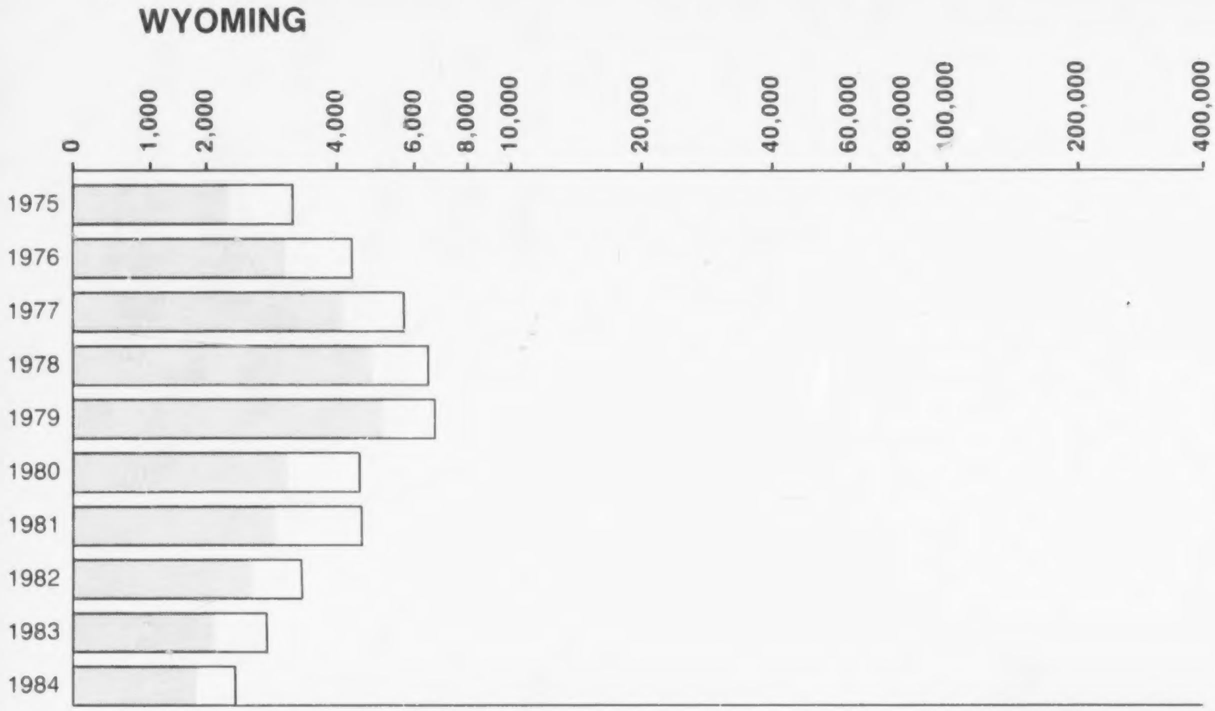

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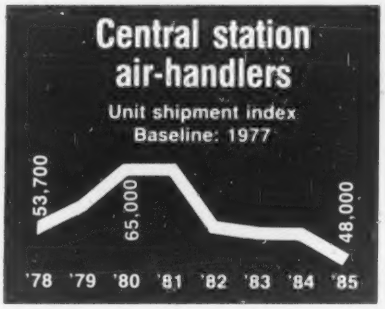
ket and placed them in another category that is not reported publicly.

Central station air handlers

Shipments of central station air handlers, at 47,900 units in 1985, were down 8% from the total of 52,100 units in the previous year. Look for a drop of about 5% in 1986.

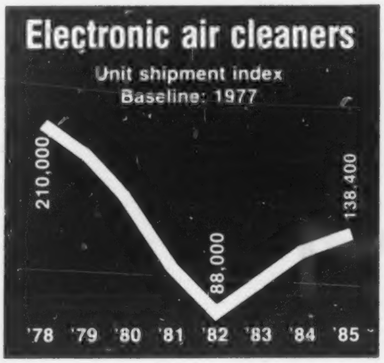


Electronic air cleaners

Total shipments of electronic air cleaners (eac's) improved again in 1985, this time by 10% to a total of 138,400 units. The total for 1984 was 125,800 units.

Although the improvement in housing activity was credited with the increases of the last two years, eac manufacturers are hoping that increased public awareness of indoor air quality problems will bring this product out of the marketing doldrums.

In addition to cleaning virtually all airborne dust and pollen from indoor air, eac's also do a creditable job on the worrisome indoor air pollutants radon and formaldehyde. It also has a special compatibility with heat pumps because of its ability to keep the indoor coil clean in winter when it runs under dry conditions.

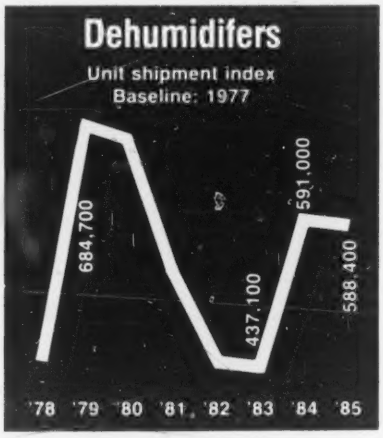


Not to be forgotten, however, is the negative impact of homeowners who spend to the limit of their budget to replace an old furnace with a high-efficiency unit. That extra cost for efficiency could eat up discretionary amounts that might have been spent for humidifiers and eac's.

Dehumidifiers

Shipments of dehumidifiers, which reached a peak of 684,700 units in 1978, were down marginally in 1985. Shipments last year totaled 588,400 units, only 0.4% below the 591,000-unit total for the previous year.

It might be noted that, in its latest report, the Bureau of the Census reported that 861,323 dehumidifiers were shipped in 1984, an increase of 41.2% from the total of 610,013 units shipped in the previous year.



Refrigerants

Shipments of the three most commonly used fluorocarbon refrigerants — R-22, R-12, and R-11 — in 1985 totaled 663,263,000 pounds, down 15% from the 780,157,000 pounds shipped in the previous year, according to figures released by the U.S. International Trade Commission.

Shipments of R-11 last year totaled 162,621,000 pounds, a 12.2% drop from the total of 185,186,000 pounds shipped in 1984.

Shipments of R-12 in 1985 totaled 281,942,000 pounds, a decrease of 17% from the 339,839,000 pounds shipped in the previous year.

Shipments of R-22, at 218,700,000 pounds in 1985, were down 14.3% from the year-previous total of 255,132,000 pounds.

COMFORT AND CONSTRUCTION

From a historical perspective, the trends in comfort conditioning have been reasonably predictable. Today, however, the ground is literally shifting beneath the feet of contractors, wholesalers, and manufacturers as we write.

The reasons are twofold. The precipitous drop in world oil prices to half what they were a year ago promises to affect different product groups in different ways. So, too, the domestic natural gas oversupply "bubble," together with the gas price-depressing effect of lower residual oil costs, has had an impact.

Certainly fuel oil prices already have turned sharply downward and likely will stay well below $1/gallon for at least four or five years. Commercial and residential natural gas prices are near their peak and, in a few cities, price reductions have been announced.

The cost of electricity, of major concern in the South where cooling seasons are long and where most heat pumps and electric resistance heaters

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are located, probably will continue to edge upward over the short term. But, near the end of the decade when much of the cost of extra generating capacity has been absorbed, electricity cost also can be expected to decline in real terms.

A major unknown in the dynamics of today's marketplace is how the homeowner and the building owner will react to these late-breaking developments. It will probably be several months before any real trends can be determined.

What does all of this mean in terms of equipment sales? It's too early to say with any certainty. But in the following pages, and elsewhere in this issue, we'll take a close look at what's happening in the major market segments. But first, let's take a look over our shoulder.

Back in the early 1970's the efficiency of an air conditioner, a heat pump, a furnace, or a boiler was largely an academic consideration. Those who made or sold equipment with efficiencies markedly ahead of the competition could find few who appreciated the difference enough to pay the premium cost.

But as energy prices escalated, manufacturers and distributors found they could no longer serve the market with equipment of any single efficiency. Virtually all now offer two efficiency ranges and many find that, with real and threatened state mandatory minimums, three efficiency ranges are a safer bet to reach all markets.

We saw the development in three phases. The first was an awareness of the need for change to avoid needlessly high energy costs. It took the form of added insulation, weatherization, the elimination of pilots on many gas-fired appliances, and an interest in solar and other renewable energy sources.

The second phase — departures from traditional equipment to designs based on new technology and a growing consumer willingness to pay more for higher efficiencies — had its beginnings in 1979 but did not develop fully until 1984. It was then, too, that the renewable energy movement reached its high-water mark.

The third phase began about 1983 and will be evident for the forseeable future. It's a time when consumer and government education is largely complete so that the job of providing substantially more efficient heating and cooling systems can go forward according to the natural dictates of the marketplace.

Industry is both on time and on target. The consumer has demonstrated an unexpectedly high degree of understanding whether or not added incentives were offered. It is government, at both the federal and state levels, that has the potential to disrupt natural market forces, particularly in relation to recent changes in fuel prices.

Heating

In the days of cheap and abundant natural gas, there was little incentive to purchase anything better than an

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inherently reliable and inexpensive atmospheric gas furnace or boiler with a standing pilot that, in most cases, burned all summer to keep rust and dampness from the simple clamshell heat exchanger.

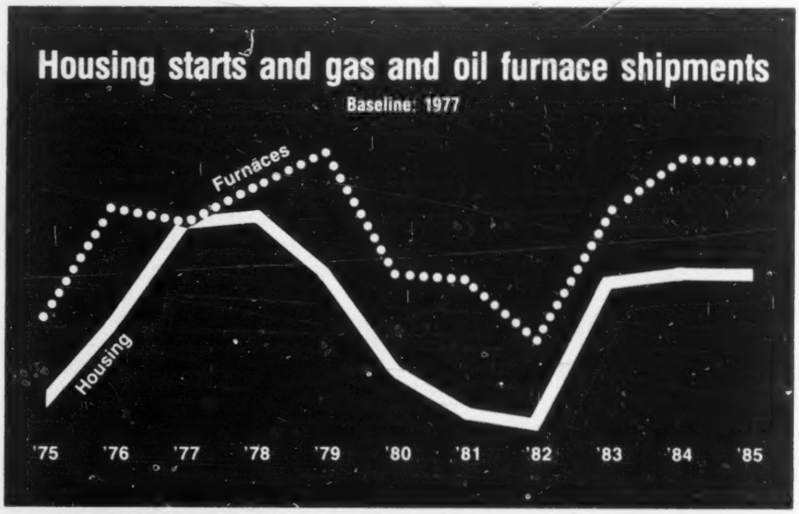
These atmospheric furnaces and boilers had a steady-state efficiency of at least 80% but, on an annual basis, they had to press hard to achieve efficiencies in the 60% range. A major part of the problem was a natural venting arrangement that bled off conditioned air up the flue whether the furnace was operating or not.

With the first stage of natural gas decontrol in 1978, which reversed the increasingly severe gas curtailments over the previous decade, came steep price increases that more than doubled gas costs, in real terms.

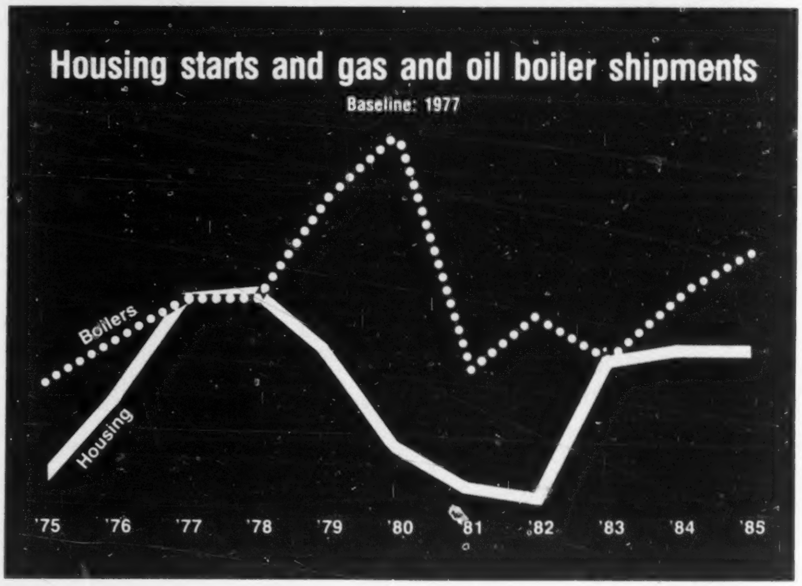
The first solution, made mandatory in some states, was an intermittent ignition device (iid) to replace the standing pilot. This increased seasonal efficiencies to the 67% to 71% range and a vent damper, which reduced the amount of conditioned air vented between operating cycles, could add another 8% or so.

The next stage was a family of furnaces with power burners, induced draft, or recuperative heat exchangers that established a new high-efficiency class with seasonal efficiencies in the 80% to 86% range. They stopped just short of condensing flue gases.

A pulse combustion boiler was introduced into the market in 1980 and, two years later, it was joined by a pulse combustion furnace. Both had annual efficiencies well over 90% and, in the last two years, virtually every major manufacturer has introduced a condensing furnace line with annual efficiencies of 90% or higher.


Housing starts and gas and oil furnace shipments

Baseline: 1977


Housing starts and gas and oil boiler shipments

Baseline: 1977

The new market

These developments had been watched with more than passing interest by consumers eager to control fast-rising fuel bills. The result was a whole new market revolving around the replacement of inefficient equipment in good working order for the sake of efficiency.

In fact, 1984 was the first year in which consumers had anything like a full selection of efficiencies from nearly all manufacturers.

A breakdown of manufacturer shipments by efficiency range reported by the Gas Appliance Manufacturers Association (GAMA) illustrates the dramatic change in consumer buying habits. The report includes upflow, downflow, and horizontal furnaces expanded to show total industry volume.

In 1983, a total of 443,740 gas furnaces, or 26.7% of the total, had seasonal efficiencies below 65%. These were the conventional furnaces of as recently as five years ago. Last year, shipments of gas furnaces with annual fuel utilization efficiencies (AFUE's) of less than 65% totaled 271,375 units, or only 14.9% of shipments.

At the other end of the spectrum, 256,120 gas furnaces shipped in 1983, or 15.4% of the total, had AFUE's of 80% or better. In 1984 the percentage had risen to 31% and, last year, the 568,955 furnaces in this category accounted for 31.3% of shipments.

Shipments of gas furnaces in the above-86% AFUE condensing range increased from 116,805 units in 1983, or 7% of the total, to 206,050 units or 11.2% of the total a year later. Last year, this category increased marginally to 223,355 units, or 12.3% of total shipments.

The biggest growth segment came in the category which included gas furnaces in the 71% to 80% AFUE range. Shipments of these units doubled — from 93,205 units (5% of shipments) in 1984 to 188,730 (or 10.4% of shipments) in 1985.

Other figures supplied by GAMA showed that the picture for oil-fired

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furnace shipments was a bit different. The 30,830 oil furnaces with AFUE's of 80% or better amounted to 24.2% of total shipments in 1983. A year later that percentage had increased to 32.2% and, in 1985, a total of 51,340 oil furnaces, or 34.9% of shipments, were in this category.

Oil furnaces with AFUE's of less than 75%, however, also have grown as a percent of total shipments. In 1983 it was 5.9% of shipments. A year later it was 8.4% of shipments. And in 1985 the 13,970 oil furnaces in this category accounted for 9.5% of shipments. Meanwhile, the 75% to 80% AFUE category dropped from 59.4% of shipments in 1984 to 81,970 units, or 55.7% of shipments, last year.

The expectation that 40% of gas- and oil-fired furnaces shipped in 1985 would have AFUE's of 80% or better clearly was not met. Aside from the fact that the efficiency upgrading of this market was accomplished naturally and without incentives, there were other factors that may have influenced this flattening of the growth curve.

There are indications that there still are problems with condensation within the venting systems of noncondensing furnaces in the 83% to 86% seasonal efficiency range, and in the heat exchangers of condensing furnaces that use indoor air for combustion.

The problem — premature corrosion of heat exchangers and venting systems — is caused in large part by residual sulfur in natural gas and by a wide range of contaminants in indoor air that produce acids in the condensate. These acids attack furnace components and masonry chimneys.

Both the research community and the furnace manufacturers are aware of the problems. Partial solutions include new plastic venting systems and standards, better stainless steel formulations for heat exchangers, and furnace designs that make sure unintended flue gas condensation does not occur in either the furnace vent components or in outside-wall masonry chimneys. Some designs use outdoor air for combustion on grounds it is more predictable and has much less corrosion potential.

Manufacturers have charged that a significant number of contractors are resisting the sale and installation of high-efficiency furnaces. Contractors have countered that many of the new designs have serious component problems caused, they suspect, from rushing products to market too fast to meet competitive pressures. The same was true in the early days of intermittent ignition devices (iid's).

On one subject, however, they appear to agree. Both say they have much to learn about the power venting necessary to many high-efficiency designs. It is an area of education that, to date, has been largely neglected.

Elsewhere on the heating front, it's estimated that eight of ten replacement oil burners sold today are flame retention-head or other high-efficiency types. Oil furnaces and boilers, which were almost knocked out of the market by the second oil price shock of 1978-1979, are making a modest comeback in the Northeast.

Despite the halving of world oil prices in the last year, however, it would be a mistake to expect oil-fired equipment to enjoy a conversion boom similar to that experienced by gas-fired equipment at the turn of the decade. Sales of oil-fired equipment certainly will increase but the limitations of oil fuel distribution in all probability will prevent a massive shift.

The winter

Unlike the previous heating season, when a bitterly cold January dominated the weather picture, the October-through-January (1986) period this heating season has produced normal temperature-related heating demand, according to the National Oceanic and Atmospheric Administration's climate impact assessment.

The national residential heating costs for the period were estimated at $30.2 billion, or 1% below normal. Put another way, the average heating customer's bill nationwide was $3 less than it would have been with normal temperatures. Contrasted with the same period a year earlier, this heating season was 1% colder.

The estimated change in the temperature-related use of the two major heating fuels by residential customers for the season through January was: natural gas down 62.3 billion cubic feet; and electricity up 868 million kWh.

On a world basis, oil consumed for heating was estimated as 2% less than normal for the October-through-January period. A cold November in Europe and a cold December in North America was offset by a mild December in Europe and a mild January in North America. Japan has been 2% colder than normal.

Builders and energy

On average, today's new homes use only half as much energy for heating and cooling as they did a decade ago, according to Ralph J. Johnson, president of NAHB Research Foundation. He expects energy use per dwelling to decline by another 25% to 50% over the next decade.

In the minds of builders, however, affordability has become more important than energy. Three out of four households 25 years ago could affort to buy a new home. Now it's one of ten. A survey of college seniors revealed that their major concern was a lack of ability to buy a new home even a decade or more into the future.

Even so, he said dramatic improvements in the home heating costs have been made in the last decade. In a 1983 builder opinion survey, 69% said they were building, or anticipated building, separate energy-efficient homes. It had been 85% a year earlier. For 1984, they were divided between building more or the same number of energy-efficient homes. There were some regional differences, with the highest commitment to energy efficiency in the Midwest and the lowest in the West.

To achieve energy efficiency, builders listed in order of importance: R-32 or more insulation in ceilings, R-18 or more in walls, R-16 or more in floors, R-13 or more in basement walls; double or triple glazing; insulating sheathing; house orientation; 6-in. wall studs; air-to-air heat exchangers; passive solar water heating; and all-weather wood foundations. Equipment efficiency was not mentioned.

Of the total surveyed, 62% said utilities in their areas had programs to encourage energy-efficient home building. But only 4% of lending institutions offered lower interest rates or alternative financing to encourage the production and sale of energy-efficient homes.

In order of importance, builders said they needed more information on: how to economically achieve higher insulation values; indoor air quality; limiting infiltration; moisture control; vapor barriers; passive solar space and domestic hot water heating.

In terms of what features home buyers were most aware of, builders replied: increased insulation; double- and triple-glazed windows; energy-efficient heating and cooling equipment; storm windows and doors; insu-

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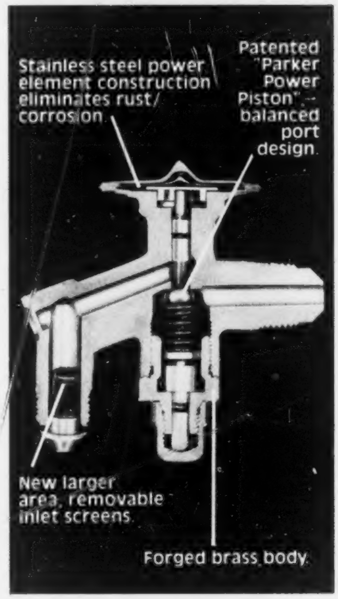
Thermostatic expansion valves with balanced port design.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lating foam sheathing; and solar space heating in that order. They ranked the features they were willing to pay extra for in the same order.

Increases in insulation levels were dramatic in the period 1973 to 1977 but, since 1977, improvements have been modest. Single-glazing was used in 74% of homes built in 1974 but, by 1983, it was reduced to 38%. Double-glazing changed from 26% of homes in 1974 to 55% in 1983. Triple-glazing changed from less than 1% in 1974 to 7% in 1983.

In multifamily units, however, single-glazing shifted only from 71% in 1974 to 48% in 1983. Double-glazing increased from 29% to 46% and triple-glazing from less than 1% to 6% in the same period.

Indoor air quality and its relation to the reduction of air infiltration is a major issue with builders, according to Johnson. They want to know the acceptable levels of various indoor air contaminants based on sound epidemiological research.

Builders have reservations about air-to-air heat exchangers. Johnson said NAHB's EER-1 2,400-sq-ft-test home, equipped with an air-to-air heat pump, used 3,422 kWh for a 5,460 degree day winter. Not only would the use of air-to-air heat exchangers more than double the cost of space heating, he said, but leakage around even expensive mechanical dampers would have dramatically increased the air infiltration rate even when the unit was not running.

"We don't wish to return to the days of drafty homes with leaky doors and windows, nor do our customers want that," he said. "But without a sensible resolution of this issue, it will be increasingly difficult to convince builders and buyers that they need an energy-efficient home."

Heat pumps

Electric furnaces, which for many years simply replaced electric baseboard and ceiling cable systems so that ducted central cooling also could be provided, now are playing second fiddle to air-to-air heat pumps.

These heat pumps have captured an ever-increasing share of the new home market — about 30% of new single-family homes and 40% of new multi-family units last year. In many heat pump installations, the electric furnace provides the back-up heat source.

The initial reason for the popularity of the air-to-air heat pump was the lack of natural gas availability in many markets until 1978. But with more than half of new home construction over the past few years in the South, which requires a lot of cooling and minimal heating, the heat pump has retained its popularity.

Other factors also came into play. The trend toward condominiums and garden apartments helped heat pumps. And an industry-wide overhaul of heat pump design, with resulting improvements in reliability and cold climate adaptability, also fostered more confidence in this approach.

A development that has moved slowly in the marketplace is the replacement of split-system comfort cooling units with split-system heat pumps on gas and oil furnaces. The heat pump provides summer cooling and heating when outdoor temperatures are above the balance point (the point at which the heat pump can still provide 100% of heating requirements). The fossil fuel-fired furnace takes over at a heat pump cutoff point determined by the relative costs of fuel.

Gas utilities dislike the arrangement and have tried, with only limited success, to put demand charges on such installations on grounds that they are required to make gas available when the weather is at its coldest and demand is at its peak, yet they lose virtually all of the revenue from the spring and fall.

With the dramatic improvement in the efficiencies of gas- and oil-fired furnaces, however, it would appear that the arguments of whether this combination really saves money become increasingly academic.

The heat pump, however, still has a magic about it that the gas industry envies. It has devoted a lot of time and money to the development of a gas-fired heat pump that can compete

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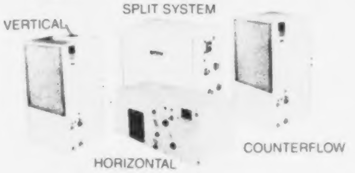

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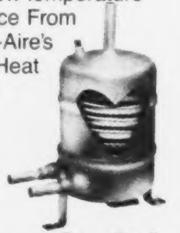

Patent Pending

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Circle 10

Heating-cooling-fuel new home characteristics

(Based on two quarters revised, one quarter preliminary Census Bureau figures. All numbers are rounded.)

	1984					1985				
	U.S. total	Northeast	North Central	South	West	U.S. total	Northeast	North Central	South	West
Single-family homes completed	**751,000**	85,000 11.3%	110,000 14.6%	379,000 50.4%	177,000 23.6%	**771,000**	119,000 15.4%	103,000 13.4%	337,000 48.9%	172,000 22.3%
Space heating fuel										
Gas	341,000 45.4%	37,000 43.5%	77,000 70%	130,000 34.3%	96,000 54.2%	335,000 43.4%	46,000 38.7%	78,000 75.7%	108,000 28.6%	103,000 59.9%
Electricity	362,000 48.2%	28,000 32.9%	22,000 20%	242,000 63.9%	69,000 38.9%	385,000 49.9%	46,000 38.7%	22,000 21.4%	259,000 68.7%	58,000 33.7%
Oil	16,000 2.1%	14,000 16.5%	1,000 0.9%	— —	— —	20,000 2.6%	20,000 16.8%	— —	— —	— —
Other/none	32,000 4.3%	6,000 7.1%	10,000 9.1%	7,000 1.8%	12,000 6.9%	31,000 4.1%	7,000 5.8%	3,000 2.9%	10,000 2.7%	11,000 6.4%
Heating systems type										
Warm air furnace	419,000 55.8%	29,000 34.1%	86,000 78.2%	201,000 53%	105,000 59.3%	422,000 54.7%	44,000 36.9%	84,000 81.5%	183,000 48.5%	105,000 61.1%
Heat pump	225,000 30%	12,000 14.1%	8,000 7.3%	155,000 40.9%	49,000 27.7%	236,000 30.6%	22,000 18.5%	10,000 9.7%	169,000 44.8%	35,000 20.3%
Hydronic	30,000 4%	25,000 29.4%	3,000 2.7%	— —	— —	33,000 4.3%	28,000 23.5%	4,000 3.8%	— —	— —
Electric baseboard/ panel/radiant	42,000 5.6%	17,000 20%	8,000 9.3%	10,000 2.6%	10,000 5.6%	49,000 6.3%	21,000 17.6%	5,000 4.8%	12,000 3.2%	11,000 6.4%
Other/none	35,000 4.6%	2,000 2.4%	5,000 2.5%	13,000 3.5%	13,000 7.4%	31,000 4.1%	4,000 3.5%	— —	13,000 3.5%	21,000 12.2%
With central air conditioning	537,000 71.5%	28,000 32.9%	62,000 56.4%	350,000 92.3%	97,000 54.8%	542,000 70.3%	49,000 41.1%	63,000 61.1%	346,000 91.7%	84,000 48.8%
Multifamily homes completed	**459,000**	33,000 7.1%	46,000 10%	264,000 57.6%	116,000 25.3%	**476,000**	33,000 6.9%	55,000 11.6%	234,000 49.2%	154,000 32.3%
Space heating fuel										
Gas	121,000 26.3%	14,000 42.4%	25,000 54.3%	34,000 12.9%	47,000 40.5%	144,000 30.2%	18,000 54.5%	26,000 47.2%	26,000 11.1%	74,000 48.1%
Electricity	329,000 71.7%	14,000 42.4%	20,000 43.5%	230,000 87.1%	65,000 56%	327,000 68.7%	13,000 39.3%	30,000 54.5%	207,000 88.4%	77,000 50.0%
Oil	4,000 0.8%	4,000 12.1%	— —	— —	— —	1,000 0.2%	1,000 3.1%	— —	— —	— —
Other/none	5,000 1.2%	1,000 3.1%	1,000 2.2%	— —	4,000 3.5%	4,000 0.9%	1,000 3.1%	— —	1,000 0.5%	3,000 1.9%
With air conditioning	412,000 89.8%	22,000 66.6%	42,000 91.3%	262,000 99.2%	85,000 73.2%	417,000 87.6%	21,000 63.6%	53,000 96.3%	229,000 97.8%	114,000 74.0%

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head-on with electric heat pumps.

Although technically feasible, the Gas Research Institute reports that a gas heat pump is still some years away because, in order to justify the anticipated first-cost premium, it must be more efficient than its electric counterpart. And with the efficiencies of electric units moving steadily upward, they make for a difficult moving target. Another development to watch, however, is a group effort by Japanese manufacturers concentrating on gas engine-driven heat pumps.

Even though they are sold in much fewer numbers than other heating systems, water-source heat pumps are making themselves felt in some northern markets, particularly in the Midwest. They have been used in the South, especially in Florida, for many years.

Most of the early "cold water" units used water from a well, a pond, or the ocean. Water quality and quantity usually was unknown until the job was started and, often, a separate return well had to be drilled. For these reasons, these early installations were largely a rural phenomenon.

Within the past few years, however, researchers and some enterprising entrepreneurs have developed vertical and horizontal closed-loop designs using plastic pipe and a water-glycol solution that substantially reduces drilling and pumping costs and makes the system practical for an urban lot.

These systems provide ultra high-efficiency cooling and high-efficiency heating without the need for backup heating. But the high first cost — about two to three times the cost of a high-efficiency gas furnace — and the individual engineering required promises to limit the market.

Legislation

When the U.S. Department of Energy ruled that mandatory energy efficiency minimums for furnaces, boilers, air conditioners, and other major home appliances were not necessary, the industry breathed a collective sigh of relief. The only problem was whether DOE would grant exemptions from the ruling to the handful of states which had established their own minimums.

That all changed in the last year, however. A lawsuit brought by the Natural Resources Defense Council produced a federal court ruling that, in effect, sent DOE back to rethink the whole question. It's likely, then, that later this year we will again see proposals for mandatory minimums.

Meanwhile, the states have been given license to implement their own standards. At the same time, the Federal Trade Commission-mandated labels and fact sheets also serve to inform the consumer about the relative efficiencies of these appliances.

Cooling

In the late 1960's and early 1970's the condenser surfaces on central air conditioners got smaller and smaller and condenser fan speeds got higher and higher as manufacturers tried to hold the line on price in a competitive market dominated by builder purchases.

The EER's (energy efficiency ratios) didn't matter so long as the first cost was low. Electricity was cheap and, after all, the builder didn't have to pay the utility bills. But as electricity costs spiraled upward, particularly in the South where cooling seasons are long,

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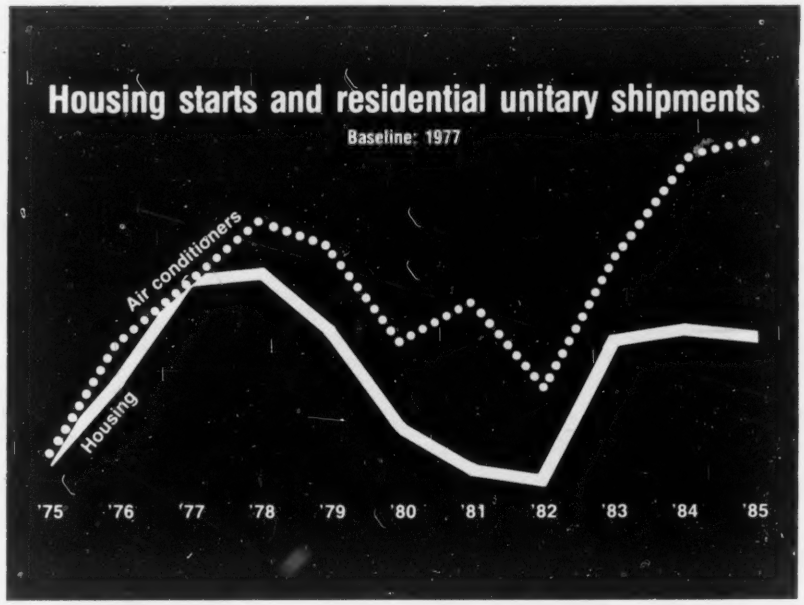
the industry began developing equipment to meet this growing new market.

In the early stages, the builder held to low-cost, low-efficiency units. But as home buyers became more knowledgeable and more demanding, and as manufacturers developed equipment with higher efficiencies for the add-on and replacement markets, some builders began opting for better units as part of an energy-saving merchandising package.

Within the hvac industry, condenser surfaces were expanded and multiple-speed condenser fans were added, moves that made outdoor units quieter as well. The push by a growing number of municipalities for sound ordinances to control air conditioner noise all but disappeared. Too, as air conditioning penetration increased, more windows were closed at night.



Compressors were improved and two-speed models were offered by several manufacturers. Larger commercial equipment began to routinely come equipped with multiple compressors to provide more modulation and, coincidentally, to provide lower first-cost benefits because of the economies of scale in the manufacture of smaller compressors.

The performance of heat pumps, particularly in northern locations, was improved significantly. Cooling performance, although still a compromise, was upgraded to a point where it rivals the best straight-cooling units. Compressors were beefed up to handle the rigors of more defrost cycles in the north. Defrosting methods and controls, some of which provide improved diagnostics, were upgraded.

According to our records, those moves started to show in the marketplace in 1973, which meant that laboratory work and field tests were going on long before that. We arbitrarily picked an SEER (seasonal energy efficiency ratio) as the line separating high-efficiency equipment from the rest. Until 1976, we doubt that much more than 15% of the units shipped could be classed as high efficiency units.

That picture has changed dramatically.

The Air-Conditioning and Refrigeration Institute (ARI) reported that, of 1985 shipments, the sales-weighted average of all cooling-only unitary equipment of 65,000 Btuh and under was 8.82 SEER, up from 8.66 a year earlier. In fact, 95% of all cooling-only units shipped in this size category last year had SEER's of 7.5 or better.

Similarly, the sales-weighted average for all unitary heat pumps in the same size category shipped last year was 8.56 SEER, up from 8.419 in 1984.

Because some states are pointing to possible mandatory efficiency minimums of 9 and 9.5, it's important to point out that, last year, only 38% of cooling-only units and only 24% of heat pumps shipped had SEER's of 9 or better. By the same token, only 11% of cooling-only units and only 8% of heat pumps had SEER's of 9.5 or better.

When records of this type were first kept in 1976, only 10.6% of heat pumps had an EER of 7.5 or better. Only 4.5% of heat pumps shipped that year could boast of an EER of 8.5 or better. In 1985, 97% of heat pumps under 65,000 Btuh had an SEER of 7.5 or better, 90% had an SEER of 8 or better, but only 34% had an SEER of 8.5 or better.

Although a few states have established mandatory minimum efficiencies for comfort cooling equipment, we doubt that these regulations have had more than a minor impact on raising the overall efficiencies of national shipments. The progression upward simply has been too regular, with no sudden shifts when state regulations came into force.

A more important factor in the acceptance of higher comfort cooling equipment efficiencies, with their associated higher first costs, has been the magnitude of incentive programs launched by summer-peaking electric utilities seeking to postpone the addition of additional generating capacity. They find it less expensive to pay a homeowner or contractor $300 to $300 for installing high-efficiency equipment than to pay up to $1,500 a peak kilowatt for new power plants.

Because of these incentives, homeowners have been recovering a large portion of the first-cost premium for high-efficiency equipment. In fact, industry shipment statistics indicate that some have been replacing inefficient equipment in good working order so they can lower their operating costs.

In all, more than 50 electric utilities are offering incentives of some type. The number is unlikely to grow much larger because, as some utilities initiate new programs, others will drop out as they accomplish their mission. The number of gas utilities offering incentives is believed to be much smaller and, for the most part, they take the form of low- or no-interest loans for high-efficiency equipment.

There are strong indications also that the homeowner does not always require monetary incentives or man-

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datory minimum efficiencies to make a wise choice.

This is borne out by the overall record of the comfort cooling and heat pump markets, which show higher average efficiencies than incentives or regulations can explain, and by the record of the comfort heating market over the past four years now that high-efficiency choices are widely available. The shift in heating efficiencies came with little or no help from the utilities.

Room units

The Association of Home Appliance Manufacturers (AHAM) reported that the sales-weighted average of all domestic room air conditioners shipped in 1983 was 7.29 EER, a 21.9% improvement over the 5.98 EER average for 1972 shipments.

New developments in heat exchanger technology now on the horizon promise to help boost the efficiencies of room units substantially. A major problem with single-package room unit efficiency improvement has been the need to expand condenser coil surface despite market-dictated physical size limitations.

Of little market value, in our opinion, have been the residential conservation service (RCS) home energy audit programs offered by many utilities either free or for a token charge. Testimony before Congress revealed that many home energy audits were ordered by middle-class homeowners looking for confirmation — and a pat on the back — for energy conservation steps they had already taken.

Similarly, the fact sheets mandated by the Federal Trade Commission for furnaces and boilers also have been a flop, according to the General Accounting Office. Its survey revealed that 80% of contractors operating in cold climates said they used the fact sheets only occasionally or never.

Housing characteristics

In keeping with our practice of past years, The News has obtained from the Bureau of the Census the characteristics of new homes completed during the first nine months of the previous year. The accompanying table on page XXX contains both national statistics and, because these figures have an annoying habit of clouding local experience, a regional breakdown as well.

It's important to note that these figures are for reported home unit completions and not for home starts, which are reported elsewhere in this issue. Therefore the increase in 1985 completions from 771,000 single-family and 476,000 multifamily completions in the first nine months of 1985 over the 751,000 single-family and 459,000 multifamily completions in the same period a year earlier are not statistically important.

Looking at fuels for single-family homes, the gas share declined from 45.4% in 1984 to 43.4% last year while both electricity (from 48.2% in 1984 to 49.9% last year) and oil (from 2.1% in 1984 to 2.6% last year) gained slightly. The share of "other" fuels dropped slightly from 4.3% in 1984 to 4.1% last year.

In the multifamily sector, however, the gas share increased from 26.3% in 1984 to 30.2% last year. The gain came largely from electricity, which declined from a 71.7% share in 1984 to 68.7% a year later. Oil slipped from 0.8% to 0.2% and "other" fuels declined from 1.2% in 1984 to 0.9% last year.

Although single-family home heating system shares remained fairly constant, there were some small shifts. Warm air furnaces dropped from 55.8% in 1984 to 54.7% last year; heat pumps gained slightly from 30% to 30.6%; the hydronic share was up from 4% to 4.3%; electric baseboard and panel heating systems increased from 5.6% in 1984 to 6.3% last year; and "other" systems dropped from 4.6% to 4.1%.

The penetration of central air conditioning in single-family homes completed last year was 70.3%, down slightly from the 71.5% rate in the previous year. Of the multifamily units completed during the first nine months of last year, 87.6% were air conditioned. That's down slightly from the 89.8% rate of a year earlier.

It should be noted that, in the South where 48.9% of single-family and 49.2% of multifamily completions were located last year, the penetration of air conditioning was 91.7% for single-family homes and 97.8% for multifamily units. In 1984, 92.3% of single-family and 99.2% of multifamily homes completed in the south were air conditioned.

The penetration of heat pumps in single-family homes completed in the South last year was 44.8%, up from the 40.9% penetration rate of 1984. Heat pumps were installed in 20.3% of single-family homes completed in the West last year, down from 27.7% a year earlier, but the rate in the Northeast increased from 14.1% in 1984 to 18.5% last year. The Midwest trailed with 7.3% in 1984 and 9.7% last year.

Even though U.S. homeowners have indicated clearly they want the availability of comfort cooling, we suspect they are using it quite differently than they did a decade or more ago when electricity was relatively inexpensive.

Instead of running their air conditioners all summer, many today open their windows during mild weather and use their air conditioning only during very hot or humid days. A 1982 study conducted by the Energy Information Administration would appear to confirm that notion.

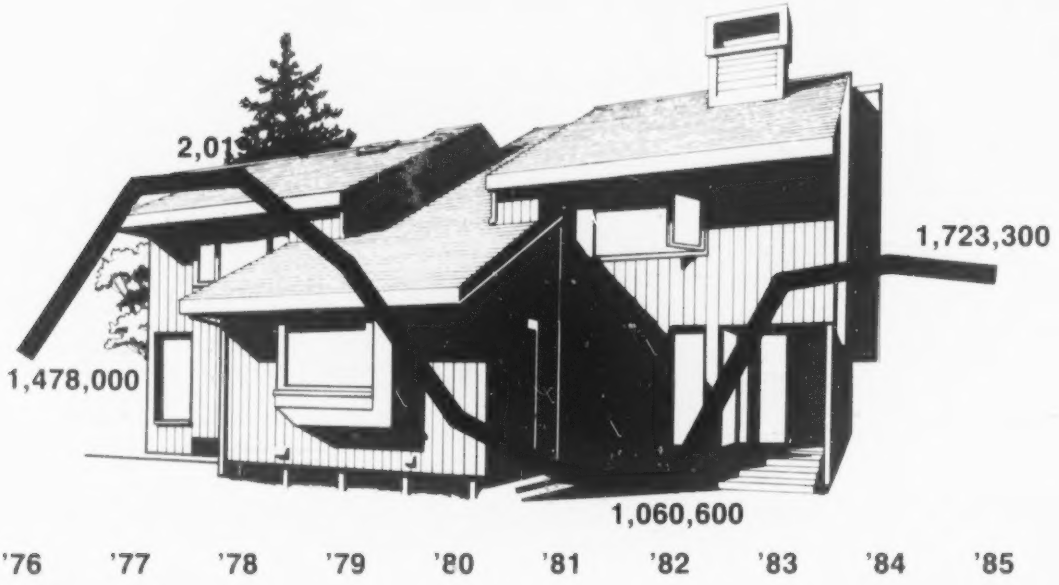
The survey indicated that, of those homes with central air conditioning, 32.6% let it run all summer, 38.9% used it only a few times, 20% used it quite a bit, and 4.5% didn't use it at all. Another 4% didn't live in the home that summer.

Of those who used room units, 11.1% let them run all summer, 60.2% used them only a few times, 13.2% used them quite a bit, 10.4% didn't use them at all, and 5% didn't live in the home that summer.

Of those with a family income of $35,000 a year or more, 29% opted to use their air conditioner all summer. And of those living in areas with 2,000 cooling degree days or more, 47% used their air conditioners all summer and another 16.3% used theirs quite a bit.

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.

HOUSING AND CONSTRUCTION



Conventional Housing

**Private starts index
Baseline: 1977**

A decline in housing starts in 1985, as builders and those involved in the industries served by this publication found out, is not necessarily bad — particularly if the decline was only 1% and it was the third consecutive year of recovery from the worst period, in 1981 and 1982, since World War II.

Stability has been the key to housing over the past three years even though there have been some regional shifts. The 1,723,300 housing starts last year were only 1% below the 1984 start rate of 1,749,500 units. Perhaps even more important, however, is the expectation that 1986 will provide yet another year at approximately the same national level of activity.

In contrast to the near panic of only a few years ago when many felt federal overspending would dry up mortgage markets, there is plenty of mortgage money available today at rates which are, historically at least, attractive. Rates are 2% lower than a year ago and lending institutions can be expected to continue their aggressive ways in 1986 simply because mortgages offer better returns than most other contemporary investments.

Despite this rosy outlook, bolstered by continued modest economic growth and no recession in the offing, housing starts have been prevented from going higher by affordability problems.

Many prospective home buyers have experienced wage freezes or increases at or less than the inflation rate. The perception of homes as a hedge against inflation lost its urgency in the past two years when values escalated at less than the economy as a whole. And, too, the urge to move from rental units has been blunted in some key markets — particularly in the South — by overbuilding.

The multifamily market, buoyed by fears that tax-exempt revenue bonds may be a victim of tax reform and renewed interest from tax shelter syndicates, continued strong last year. The outlook for 1986 is mixed.

1985 experience

Private housing starts, at 1,723,300 units in 1985, were less that 1% below the 1,749,500 starts recorded in the previous year. In contrast, the total for 1982 in the depths of the recession was 1,062,200, or less than the total for single-family dwellings last year.

In fact, the 1,065,700 single-family homes started in 1985 marked the third year in a row when this classification topped the one million mark. Last year's total was 1.5% below the 1,084,200 total for 1984 but was almost a wash with 1983 experience. The comparable figure for 1982 was 662,600 units.

Multifamily housing units in 1985 totaled 657,600 units, only 1.2% behind the year-earlier total of 665,400

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HOUSING AND CONSTRUCTION

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units and still well ahead of the total for 1983 of 635,500 units. The comparable figure in 1982 was 399,600 units.

The recovery of markets outside of the South, particularly in the Northeast and West, has led to a slight shift in housing market emphasis. The South, troubled by a weakened energy industry, slipped from a 49% market share in 1984 to 46% last year. In 1982, the South's share was 54%.

At 234,500 units in 1985, the Northeast experienced a 15% gain over the 203,700 housing starts recorded the previous year. The West, with 471,200 starts last year, showed a 4% increase over the 1984 total of 453,300 units. The Midwest, after a somewhat slower recession recovery, slipped 8% from 244,700 starts in 1984 to 224,800 starts last year. The nation's biggest market, the South, also dropped by 8% from 865,700 units in 1984 to 792,900 units last year.

National and even regional statistics often disguise what may be happening in states and local areas. In the Northeast, for example, the level of building activity in New Hampshire, New York, Massachusetts, Maine, and Connecticut is well above the average for the region.

In the West, California and Hawaii are top homebuilding markets while Montana, Arizona, and Wyoming have major problems. Similarly, the Midwest markets of Michigan, Indiana, and Ohio are reasonably strong. Not so is the farming country of Iowa, Kansas, Nebraska, Kansas, or the Dakotas. In the South, the strongest markets are in Alabama and North Carolina. The weakest: District of Columbia, Oklahoma, Louisiana, and Texas.

1986 forecast

Conventional wisdom helps little when trying to forecast what will happen to housing in 1986, a year of contradictions. In a cyclical age, the nation's economy is entering the fourth year of expansion, however modest, and we should be looking for a downturn in the forseeable future. But just as there is no boom in sight, there is no recession either. Only more slow growth.

Demand for single-family housing is still with us. There are mortgage funds aplenty. In fact, look for lenders to be more aggressive this year. In conventional times housing starts should be 500,000 to 600,000 units higher. The reason they aren't is explained in one word: affordability.

One of the crises in home mortgages rates has been all but eliminated. The availability of funds, a critical consideration only three years ago when thrift institutions were losing the battle to attract savings, was resolved with the variable rate mortgage and other forms of creative financing. But while mortgage rates have tumbled from the mid teens to a more acceptable 11% to 12%, they are still high for first-time buyers hampered by minimal wage increases and stiffened qualification guidelines.

Although the Midwest has shown some sparks of life and the Northeast has exhibited sustained growth, the boom in the South — which still accounts for nearly half of new home starts — fizzled and the West's rebound came late in the cycle. The depressed agricultural and energy-producing states, however, have shown signs that the bottom has been reached and a turnaround is in the offing. It probably won't come until very late in the year, however.

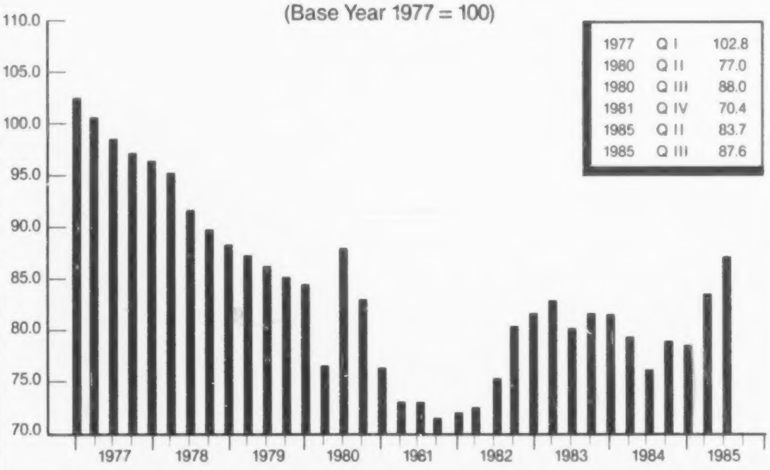
After having said all that, we still see single-family home starts this year easing ahead by 8% — from 1,065,700 in 1985 to 1,150,000 units. This means that the Northeast, Midwest, and West will do well to hold their own this year but the South, where market share has been slipping, will more than make up the difference.

Multifamily starts, if normal market precepts were applied, should show at least a 30% drop this year. There is no doubt that rental vacancies, particularly in the South, are at their highest levels since the late 1960's. The condominium market has shown no signs of recovery. Yet the multifamily market probably will do much better than that, even if for the wrong reasons.

Some of the prime factors why multifamily starts last year managed to hold within 1.2% of 1984 levels included the fear that tax-exempt bond financing soon would disappear, that tax reform would eliminate some of the more meaningful investment advantages, and the fact that many tax shelter-inspired syndicates had a commitment

NEW HOUSING AFFORDABILITY INDEX 1977–1985

(Base Year 1977 = 100)



THE AFFORDABILITY INDEX tracks mortgage payments, property taxes, depreciation and maintenance expenses, and opportunity costs. It's a ratio of income to costs compared to the 1977 base year. Source: PNR and Associates and NAHB Economics Division.

to build despite the condition of the rental market.

We don't think that tax reform, if enacted at all, will take effect in calendar year 1986. And because the same reasons for multifamily investments will hold again this year, even if with reduced intensity, we feel multifamily starts will decline by only 9% in 1986 to 600,000 units from 657,600 units last year.

Taken together, then, total private housing starts in 1986 should total 1,750,000 units. While this is only 1.5% ahead of last year's 1,723,300 units, it will mark the fourth strong year in a row for housing and the fourth year in a row for more than a million single-family starts.

The regions

In the Northeast, New York continued to lead in 1985 with a 51% growth rate over the previous year's performance. There are indications, however, that both New York and Boston, another top growth market, have peaked. Also beginning to slip are the Rhode Island, Pittsburgh, Pa., and Rochester, N.Y., markets.

The top growth market in 1986 is expected to be Nassau and Suffolk counties in New York, while multifamily starts are expected to do well in Philadelphia, Wilmington, Del., and the Trenton-Middlesex County area of New Jersey.

Steel industry layoffs and weakening auto sales have sparked caution in the Midwest markets of Canton, Ohio, and Detroit and Flint, in Michigan. Chicago, which declined 28% in 1985, is expected to be down another 10% this year. Elsewhere, Minneapolis-St. Paul, Minn., and Milwaukee, Wis., can be expected to continue strong.

Stabilization of markets in the West has had a net effect of reflecting a slight decline. Phoenix is expected to start 1986 strongly but sag at year's end for a 10% overall decline. Metropolitan areas in Washington and Oregon — particularly Seattle-Tacoma, Spokane, and Portland — have strong multifamily markets.

In Albuquerque, N.M. single-family starts continue to do well but multifamily construction has dropped by 40%. The Los Angeles-Anaheim-Riverside area of California promises to continue its 100,000 unit-plus rate. The San Francisco area expects the strong single- and multifamily markets to

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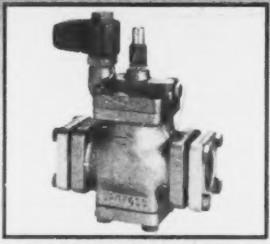

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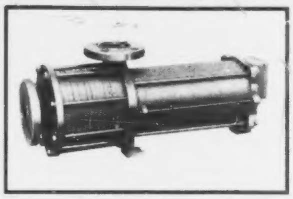

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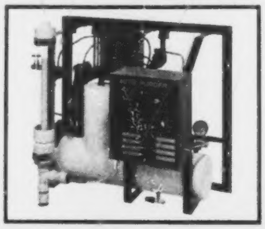

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continue. In the California markets of Fresno, Bakersfield, Stockton, and Santa Barbara, single-family home starts will continue high but multifamily units are on the decline.

In the South, Florida presents a mixed picture. The Tallahassee, Tampa-St. Petersburg, and Daytona Beach areas are weakening. But there is considerable strength in the Miami, West Palm Beach, Fort Lauderdale-Hollywood-Pompano Beach, and Jacksonville areas.

Thanks to a surge in multifamily starts, Birmingham, Ala., is doing well. In Dallas-Fort Worth, however, a 50% decline in multifamily starts overshadows a good single-family start record. Even though Houston's single-family new home inventory is low, a sluggish employment picture and a moratorium on multifamily loans promise to keep this former boom market well below previous highs. Austin and San Antonio expect a modest decline in single-family starts and a precipitous multifamily drop.

The top 20

New home construction in the top 20 local markets in 1986, which showed a 1.3% increase last year to 656,546 units, is expected to decline by 9% to 594,272 units. That's still about a third of total new home construction throughout the nation.

The Dallas-Fort Worth market slipped from first to second place in 1985 and, this year, probably will be third behind Los-Angeles-Anaheim-Riverside and Atlanta, Ga.

The 1985 records of the leaders, with 1986 expectations in brackets, follow:

Los Angeles-Anaheim-Riverside 108,000 (103,000); Dallas-Fort Worth 73,840 (46,900); Atlanta 51,430 (49,850); Phoenix 50,500 (42,500); San Francisco-Oakland-San Jose 36,700 (35,000); San Diego 35,434 (33,000); Washington 34,451 (30,600); Tampa-St. Petersburg-Clearwater 29,201 (25,915); Seattle-Tacoma 24,870 (25,915); New York 23,960 (22,710); Chicago 23,665 (17,000); Detroit-Ann Arbor 22,995 (17,900); Minneapolis-St. Paul 18,500 (18,000); West Palm Beach-Boca Raton-Delray Beach 18,352 (22,000); Raleigh-Durham 18,066 (17,500); Denver-Boulder 17,944 (17,419); San Antonio 17,860 (14,100); Philadelphia-Wilmington-Trenton 17,350 (18,050); Boston 16,875 (14,800); and Nashville 16,553 (16,628).

Affordability

The affordability issue is a perplexing one for both builders and those whose businesses depend to some degree on housing construction. With mortgage rates down 2% in a year and housing affordability at a seven-year high, there should be a boom in housing starts.

For example, the National Association of Realtors (NAR) reports that a family earning the median income of $27,940 in early 1986 makes enough money to qualify for a mortgage on a median-priced home selling for $74,800.

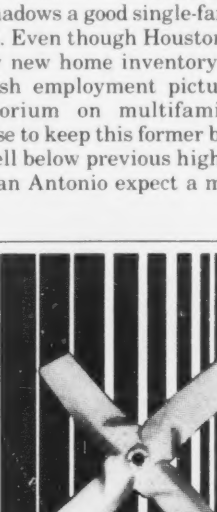
NAR officials said this is the first time half of the nation's 63 million families could afford a median-priced home since December, 1978. In their example, they said the $27,940 income was enough to qualify for a $59,800 mortgage, which represented 80% of the purchase price.

The mortgage rate used to compute the index, 11.14%, also was the lowest since August, 1978. It's important to note that a 1% change in interest rates will qualify — or disqualify — approximately 1.5 million home buyers.

A study conducted by Joint Economic Committee of the National Association of Home Builders (NAHB), however, showed that the pretax income of a middle-income U.S. family with children shrank by $3,152 over the past 11 years. (It claims 70% of all households are composed of husband, wife, and children, while 15% are composed of husband and wife only, and 15% are composed of all others.)

Last year the family had $25,836 in income before taxes in contrast with $28,988 in 1973, using constant 1984 dollars. Virtually all of the loss occurred between 1979 and 1985.

Although not quite as current, NAHB also has developed an affordability index (see chart). It tracks increases or decreases in mortgage payments, property taxes, depreciation expenses, and maintenance to compare housing affordability trends since the



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benchmark year of 1977, which equals 100.

The index increased from 83.7 in the second quarter of 1985 to 87.6 in the third quarter, mainly because of declining interest rates and an increase in family income.

There are other affordability factors, however, which are hard to quantify. One explanation of why so many are sitting on their hands when, on the surface, buying conditions are favorable comes from Barbara Alexander, vice president, Saloman Brothers, New York.

Some who buy a new home as an investment have been less than impressed with the 2% to 3% appreciation in home values in 1984 and 1985. An expected 8% appreciation this year should help. The pressure caused by an inflationary economy — buy now and save or buy now because you might not be able to afford it next year — has largely disappeared. People feel they have more time and can afford to be selective.

The widespread wage freezes, rollbacks, and minimal increases has caused many to be more cautious. They can no longer count on mortgage payments as a percentage of total income to decline. Too, with rental vacancies high in many markets, there is a good choice of rentals from which to choose and pressures caused by rent increases have eased.

Not to be forgotten, however, are the nation's poor; housing affordability is a serious problem for a growing number who live below the poverty line. The number of renter households with real incomes below $5,000 (in 1980 constant dollars) nearly doubled from 1974 to 1981, according to the Joint Center.

In 1981, more than 71% of low-income renters were paying more than 35% of their income for rent. In the same year, the Joint Center reported 11.6 million Americans were living in substandard housing and 16.5 million lived in neighborhoods judged inadequate in terms of high crime rate, unsatisfactory police protection, abandoned buildings, and poorly maintained streets.

Mortgages

Three factors came together in the early 1980's to produce a much more flexible national home financing capability: a long and serious recession accompanied by high interest rates that seriously affected the ability of thrift institutions to raise funds; more accessible computer technology to relate cash flow to market yields; and a shift in emphasis from the public to the private sector.

The traditional pass-through mortgage security was solid and had a good return but, for the investor, it was long term, could be repaid early, and generated a monthly cash flow that had to be reinvested. But in June, 1983, the Federal Home Loan Mortgage Corp. (Freddie Mac) introduced the first CMO (collaterized mortgage obligation).

These CMO's, which were also adopted by major home builders and thrift institutions, grew from $4 billion in 1983 to $11.3 billion a year later. Kent W. Colton, NAHB chief executive officer, expects to see mortgage-backed security activity in future in the $60 billion to $80 billion range. Similarly, about 50% to 60% of future mortgages will go into the secondary market.

In the third quarter of 1985, 60.2% of the homes sold, according to Home Owners Warranty Corp., were financed with conventional mortgages. Of the rest, 15.8% were FHA, 11% were VA, 2.9% were Farmers Home, 4.2% were cash purchases, and 5.9% involved some other type of financing.

The median interest rate was 11.7% and, in 87.9% of the cases, the term was 30 years. Other terms: 25 years 2.5%; 20 years 2.4%; 15 years 4.2%; and other terms 3%. Of the total, 52.1% were adjustable-rate mortgages, 43.6% were at a fixed rate, and 4.2% had some other arrangement.

Mortgages amortized over 15 years are becoming popular with some homebuyers because, at current interest rates, the comparative difference in monthly payments is not great. For example, the monthly payment on a $50,000 mortgage at 11.5% is $495 when repaid over 30 years and $584 over 15 years — a difference of only $89/month. Too, 15-year mortgages usually carry slightly lower interest rates.

At the other end of the spectrum are tax-exempt mortgage revenue bonds issued by state and local housing agencies to provide funds for home mortgages at rates about 2% below the market. It's an attempt to help alleviate the housing affordability problem and mortgages usually are restricted to first-time buyers of modestly priced homes.

State and local governments issued $12.8 billion in mortgage revenue bonds in 1984 for the purchase of 260,000 homes, of which 106,000 were new and 153,500 were existing homes. They were authorized to issue nearly $17 billion in mortgage revenue bonds in 1985, a 14% increase over 1984. Under current law, authority to issue these bonds is due to expire at the end of 1987.

Savings and loan associations and savings banks will continue to be a mainstay of the home mortgage finance system. The roles of mortgage bankers in the secondary market and commercial banks in both originating and holding mortgages is expected to expand. And with active trading in mortgage securities on Wall Street and other innovations, competition is assured for the foreseeable future.

Looked at another way, CMO's offer an attractive alternative to treasury bonds, certificates of deposit, money market funds, and other investments where the rate of return is considerably less. As long as interest rates stay in the present range, an adequate supply of mortgage funds is assured.

Leading economists pretty much agree that interest rates on fixed mortgages could fall by half a point or so by midyear, then climb to the present level near the end of 1986 as inflation in the economy as a whole moves ahead to the 5% range.

Tighter qualifications for home buyers introduced last year by the Federal National Mortgage Association (Fannie Mae) will not be relaxed, according to chairman David O. Maxwell. However, several refinements were made in January in relation to contributions from sellers and family members, appraisals, and qualifications when down payments are less than 10%.

Federal deficit

Maxwell also warned that several proposals put forward by the Office of Management and Budget (OMB) in the guise of trimming the federal budget deficit will materially affect housing if they are implemented.

The 1987 budget proposals, still to be released, would double the down payment for FHA and VA mortgages, set a top income level for FHA loan applicants at $40,000, cut the Government National Mortgage Association's (Ginnie Mae's) guarantee from 100% to 80% of the loan, cut HUD's budget for low-income housing assistance, all but eliminate rural housing, and impose a

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confiscatory tax on government-sponsored housing enterprises.

He said the proposed changes would have eliminated a third of FHA home buyers in 1984, put an immediate end to the Ginnie Mae program and, in a short span of time, render Fannie Mae ineffective. "These enterprises cost the taxpayer nothing and provide a real service for home buyers of modest means."

Demographics

After a decade of record gains in which 16.8 million households were formed, household growth will slow to 14.1 million in the 1980's and to between 12 and 13 million in the 1990's, according to NAHB.

In the 1970's household growth averaged 1.7 million a year,, but the combination of a weak economy and the high cost of housing forced the rate down to about 1 million in the early 1980's. With the economic recovery, however, household growth responded to an annual rate of about 1.5 million.

The Harvard-MIT Joint Center for Urban Studies forecasts that households will continue at the 1.5-million rate until the end of the decade and then drop to the 1.2 to 1.3 million range in the 1990's.

From a base of 228 million in 1980, population is expected to grow by 9.6% to 250 million by 1990 and by 7.3% to 268 million by the year 2000.

Growth of the 24- to 34-year-old age group, however, will decline sharply in the 1980's and turn negative in the 1990's. Those aged 35 to 44 will increase by 46.2% in the 1980's, up sharply from the 11.8% increase in the 1970's. The population aged 18 to 24 already has peaked.

Population and employment will continue to flow from the Northeast and Midwest to the South and West for the rest of this century, according to Bureau of the Census projections. The West will grow at a 22% rate in the 1980's and 18.1% in the next decade. The South will increase by 15% in the 1980's and 12.8% in the 1990's.

Along with the shift from the Frostbelt to the Sunbelt, NAHB reports a marked but uneven trend in which the population in nonmetropolitan areas is increasing at a faster rate than the total population. These population shifts, which slowed during the recession, generally reflect the movement of employment to lower-wage areas.

In 1970, the Joint Center reported that only 19.8% of unmarried persons over age 15 lived alone. Changing lifestyles, including a trend toward delayed marriages and higher divorce rates, brought about an increase to 24.4% in 1980. Even though the baby boom will continue to fuel the growth of single-person households for a few years, recent trends in marriages and divorces indicate an accelerated pace in married couple households through the 1990's.

In fact, the aging of the baby boom will be marked by a return to the traditional family-oriented pattern of household growth. Married couples will stabilize at about 54% of all households by 1990.

In 1980, for example, the Joint Center said 27.4% of the 80.3 U.S. million households housed married couples with children, 33.4% housed childless married couples, 6.8% were other households with children, and 37.9% were other households without children. By 1990 the shares will be: 21.8% married couples with children, 31.9% childless married couples, 6.1% other households with children, and 40.2% other households without children.

Although many baby boom families are only just approaching their child-rearing years, it appears that the average number of births per woman will range from about 1.8 to 2.2. The decline in fertility, according to NAHB, is more a result of fewer women having three or more children than it is an increase in the number of women having no children.

Preferences

The NAHB 1985 survey of 4,500 single-family homeowners living in their own homes indicated that consumer perceptions about energy, while still paramount, have changed considerably in the past five years.

In a similar survey in 1980, 36% said the energy situation was extremely serious and 74% said it would be serious within five years. In the 1985 survey, 22% said they think the energy situation is extremely serious and only 45% think it will be serious five years from now.

An open design (81%), large kitchen, quality materials, a two-car garage, fireplace, and central air conditioning (64%) were among top priorities. About two-thirds of consumers are willing to pay for extra insulation and half are willing to pay for thermal pane or storm windows.

Single-family detached homes are the best hedge against inflation, according to three out of four homeowners surveyed in 1980. In 1985, only half of respondents agreed with that statement. Land was listed as the second best hedge against inflation in both survey years.

In similar surveys conducted in 1980 and 1985 by the Joint Center for Housing Studies, single-family detached homes (75% in 1980, 49% in 1985) again topped the list and land (55% in 1980, 33% in 1985) also was second. In 1980, gold, diamonds, stocks, silver, and mutual funds followed in that order. In 1985, the rankings were mutual funds, stocks, gold, condominiums, and diamonds.

Remodeling

Among home improvement projects completed within the previous 12 months and listed in the NAHB Consumer Preference Survey were a new water heater (10.1%), a remodeled kitchen (9.9%), new roof (9.4%), new furnace or boiler (6%), recreation room (4.9%), and changed or added air conditioning (4.8%).

American households were expected to spend approximately $75 billion on residential alterations and repairs in 1985, according to a National Remodelers Council Economic Survey. The comparable figure for 1984 was $69.8 billion.

NAHB estimated that about 75% of the remodeling market involves professional installations and 25% are do-it-yourself projects. However, many of the council members have expressed the feeling that the market is expanding too rapidly and is attracting too many unlicensed and unprofessional firms.

As the population ages and the first wave of the baby boom approaches 40, an increasing number of the nation's home builders are redesigning their homes for trade-up buyers and the elderly.

In yet another survey of 715 builders attending the NAHB convention in Dallas earlier this year, 60% said they are now building for the trade-up and 63% said they will be building for that market by the end of the decade.

The 5% now building for the elderly is expected to increase to 14% by 1990.

The trade-up market is expected to gain an even larger share of the housing market in the years ahead because of the decline in household formations and the large number of starter homes in the inventory, according to NAHB executive vice president Kent Colton.

The rest of the 1980's and the early 1990's also will be growth years for specialty markets, especially homes designed for the elderly and adults whose children have left home. Only 34% of builders now are constructing starter homes and only 21% expect to be building for first-time buyers by the end of the decade.

The sharp recession of the early 1980's and sweeping changes in the housing finance system have accelerated the trend toward diversification. Of those surveyed, 38% plan to diversify in 1986.

Of those, 15% plan to move into commercial-industrial-institutional work and 10% will move into land development. Another 9% plan to diversify into multifamily for-sale units and a like number will move into multifamily rental construction.

Prices

New home prices through the first 10 months of 1985 averaged $83,700, up 4.8% from the average of $79,900 in the previous year. In 1984, the average was only 6.1% more than the 1983 average of $75,300.

If the inflation factor for the general economy is subtracted from these increases, it can be seen readily that the attraction of housing as a hedge against inflation has declined sharply. This is expected to improve slightly in 1986 with an expected housing inflation rate of 8%.

Similarly, the average price of existing homes sold in 1984, at $72,400, was only 3% more than the $70,300 average for the previous year while, at the same time, the Consumer Price Index (CPI) advanced 4.3%. Through the first 10 months of 1985, the average price of existing homes sold advanced to $75,400, or 4.1% higher than in 1984.

Multifamily

In 1983 there were 29.9 million rental units in the United States. Of these, about 61% were in structures with fewer than five units. Only 16.7% were in buildings with 20 or more units. Not counted in these totals is an estimated 20% of the single-family home stock which is rented, a factor some experts believe reduces new home demand by about one third.

Renters typically have lower incomes than homeowners. In recent years that gap has widened. The median income of renters was 65% that of homeowners in 1970 but, in 1983, it had decreased to 49%.

Renters also have smaller average households than homeowners. In 1980 more than a third of all renting households consisted of just one person and almost two-thirds consisted of no more than two persons. In contrast, less than one-sixth of homeowner households consisted of only one person and about half were made up of no more than two persons.

Approximately 31% of multifamily units completed in 1983 were for-sale units, down from 33% and 35%, respectively, in 1982 and 1981, but up substantially from 17% in 1975.

About 9% of one-unit homes started in 1984 were townhouses, according to NAHB. About 5% were fee-simple townhouses while approximately 4% were townhouse condominiums.

In the third quarter of 1985, U.S. rental vacancy rates shot up sharply to the highest level since 1967. The main reason was a sudden jump in the West to 6.9% from 5.3% earlier in the year.

The highest vacancy rate was registered in the South at 9.2%, substantially above the 7.8% of a year ago. The homeowner vacancy rate stood at 1.9%, the highest level on record.

Despite the high vacancy rates, however, the multifamily market continues to do reasonably well with the exception of high-rise developments and condominiums, a market traditionally driven by inflation.

The average size of a for-sale apartment or condominium in 1985 was 1,240 sq ft. The average size of a rental unit was 886 sq ft. Rents for new apartments in the Northeast last year averaged 67 cents/sq ft. Comparable figures for the other regions: Midwest 50 cents/sq ft; South 49cents/sq ft; and West 59 cents/sq ft.

Builders report they are finding a niche, even in overbuilt markets, for rental apartments that cater specifically to families or single parents with children. Larger projects, they say, should also include a day-care center. There is still a strong market also for projects that cater to empty-nesters and the elderly.

There are two factors with a major influence on the new multifamily market which distort local market demand. One is the tax shelter syndicate which, when sold out, is committed to building and often is not in touch with the local market needs. These groups have been driven in recent months by the thought that tax reform may eliminate future investments of this type.

Another major factor has been the sharp increase in the use of tax exempt revenue bonds. In the first 10 months of 1985, for example, the multifamily sector used $8 billion in these bonds in contrast to $3.2 billion for the same period in 1984.

Mobile Homes

Shipments of mobile or manufactured homes in 1985 totaled 283,489 units, a 3.9% decline from the 295,013 mobile homes shipped in the previous year, according to the Manufactured Housing Institute.

Shipments of these site-delivered homes, popular with retired people and those with moderate incomes, held steady through both the recession and the recovery.

Although not counted in the official housing statistics, shipments of these homes accounted for 26.6% of the private single-family site-built homes started in 1985. This compares to 27.3% in 1984 and 36% in 1982.

The manufactured housing market was considerably strengthened in 1983 when regulations under Section 203 (b) of Title II of the National Housing Act were changed to allow 30-year FHA-insured mortgages with limits ranging from $67,500 to $90,000. FHA will insure 97% of the first $25,000 and 95% of the remainder.

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.

LABOR

With wage-and-fringe benefit freezes predominating, settlements for new construction labor contracts negotiated in 1985 were among the smallest ever recorded, according to the Construction Labor Research Council (CLRC).

The average first-year increase was 34 cents/hour, or 1.6%. If the impact of contract language changes designed to reduce overall labor costs also is included in the equation, CLRC reported that the estimated wage increase in the first year was more like 30 cents/hour.

The average second-year increase for multiyear contracts was 71 cents/hour, or 3.4%.

The first-year settlement average for contracts negotiated in 1985 was higher than the 8 cents/hour, or 0.4%, average increase negotiated in 1984, but it must also be remembered that the 1984 increases were the smallest in more than four decades.

On closer examination, the higher average increases in 1985 were the result of fewer freezes and rollbacks. Among contracts with increases, the amount negotiated last year was no higher than in 1984.

Of those contracts negotiated in 1985, the second- and third-year increases were higher than the first-year increases. But even so, CLRC pointed out, the second- and third-year increases were lower than in 1984 and, in fact, lower than at any time since the mid-1960's.

Some of the trends of recent years were reversed in 1985. After peaking in 1981, the average first-year settlement has declined in each year since. Similarly, 1985 was the first year to show an increase in multiyear agreements since 1981.

Geographic trends continued, with the largest increases again recorded in New England and the smallest in the South Central states. Increases were evenly distributed between wages and fringes. But because fringes account for only about 20% of the total, fringes received a disproportionately larger share.

On average, wages were increased by 17 cents/hour, health and welfare by 12 cents/hour, pension by 5 cents/hour, and other contributions unchanged. The increases for health and welfare and pensions were about the same as in 1984.

About two-thirds of all contracts negotiated last year were for one year — but still fewer than in 1984. The multiyear contracts were equally divided between two- and three-year agreements. More than half of the contracts negotiated in the Northeast were multiyear pacts.

For those contracts with language changes, the average savings was 27 cents/hour. Most frequently negotiated was a reduction in the overtime premium from 2 to 1.5 times the base rate for daily and Saturday overtime. Other items included reductions in the cost of shift work, reducing or eliminating travel pay, reducing the number of holidays, and permitting a work schedule of four 10-hour days.

Construction employment has increased during the past year almost without interruption. At year's end, it was at a level of 4.75 million, an increase of 7%. Employment in 1985 exceeded the previous record year, 1979.

Despite this record, however, unemployment continued to hover between 13% and 14% as job growth just about matched the number of people looking for work. The strongest gains have been in commercial construction.

In all, the 828 construction labor contracts negotiated last year covered an estimated 535,300 workers.

Of the 64 one-year and 24 two-year agreements negotiated by United Association plumber and pipefitter locals (covering 62,000 workers), the average increase was 57 cents/hour for the first year (2.6%), and 77 cents/hour for the second year (3.4%).

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gotiated in 1985 were for one year. The increases averaged 45 cents/hour, or 2%.

Some history

In its one-in-five-years census of the construction industries, the Bureau of the Census reported there were 60,243 plumbing, heating, and air conditioning contractors in the United States in 1982. These companies employed 512,000 people and had a payroll of $9.86 billion. Annual worker hours amounted to 655.8 million.

The Census Bureau said net construction receipts for the group totaled $28.846 billion. All business receipts totaled $33.521 billion. Of each dollar of construction receipts, 30.2 cents was payroll, 39 cents was materials and supplies, 11.7 cents was subcontracts, 1.3 cents was for capital expenditures other than land, and 1.1 cents was for rented machinery and equipment.

The average contractor, according to the Census Bureau, employed 8.5 people, and had a payroll per employee of $19,300. The ratio of construction worker hours to construction workers was 1:1.6. Total construction receipts/construction worker amounted to $82,200.

INTERNATIONAL

Even though exports of U.S. air conditioning and refrigeration equipment in 1985 amounted to almost twice the value of imports, the positive trade balance that approached $2 billion in 1978 had diminished last year to $647 million.

There are many reasons for the decline, not the least of which was a hard U.S. dollar that made exports more expensive abroad and imports cheaper at home. A decline of more than 25% in the value of the dollar in relation to other major currencies within the past year may help stem the tide but it's unlikely that a major turnaround is in the offing.

The halving of the world oil price has slowed or put on hold the development plans of some of the U.S. industry's best customers in the Middle East. Other markets, particularly in South America, are severely hampered by monumental debt problems.

U.S. manufacturers have shown an increasing tendency to source components, particularly compressors, from abroad. Several have indicated, however, that this is a temporary expedient that will change when domestic manufacturers are able to offer cost-effective rotaries in quantity. Big system components for the world market have been made in the factories of U.S. subsidiaries abroad for several years now in order to minimize the effect of the hard dollar.

There is no doubt that Japan's aggressive stance as a competitor in both the world and domestic market is a major contributing factor to the frustration of U.S. marketers.

Abroad, the Japanese have been tough competitors and have made deep inroads in traditional U.S. export markets that will be hard to reclaim even if the value of the dollar becomes more favorable. And at home, Japan accounted for 59% of air conditioning and refrigeration product imports into the U.S. Its positive trade balance with the U.S. in these product areas swelled from $283.2 million in 1984 to $402.7 million last year, a 42.2% increase.

In fact, 1985 was a good year internationally for the Japanese. At a time when the U.S. trade deficit was skyrocketing, Japan's trade surplus last year totaled $46.1 billion, up sharply

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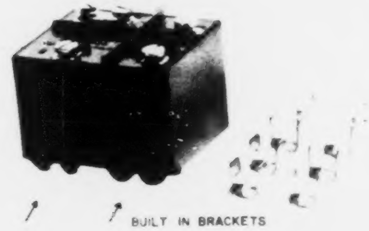

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from $33.6 billion in 1984. Its surplus with the U.S. hit a record $39.5 billion last year as a result of an 8.9% increase in exports and only a 4% increase in imports from the U.S.

Japan's Finance Ministry reported that its trade surplus with the European Community reached $11.1 billion, also a record, and that its positive balance of trade has been increasing at more than $10 billion annually since 1982 despite its much-touted surplus-curtailing efforts.

Looking across all international markets, the Center for International Business Cycle Research at Columbia Business School reports that the leading indexes — which project the future direction of the economy — of all major industrial nations except Britain and Japan are pointing upward.

The leader is Australia, where the leading index is increasing at an annual rate of 11%. Close behind are Taiwan at 10% and Italy at 9%. The leading indexes are climbing at an annual rate of 6% in Canada, 5% in West Germany and France, and 3% in the U.S. Japan displayed a growth rate of only 1% in January (it was 11% six months earlier) and Britain is declining at a 1% rate.

Trade balance

The total value of U.S. refrigeration and air conditioning exports, according to the Department of Commerce, was $1,413,837,032 in 1985, down 11.8% from the $1,603,079,407 total for the previous year. In 1981, U.S. exports totaled $2.073 billion.

At the same time, the $766,766,254 worth of refrigeration and air conditioning equipment imported into the U.S. last year was up 19.7% over the $640,481,168 total for 1984. In 1981, U.S. imports totaled $273.8 million.

Imports represented 54% of exports in 1985, up from 40% the previous year and a far cry from the 13.2% recorded in 1981. The biggest shift has been caused by the exponential increase in imported compressors. The U.S. imported 9.95 million compressors worth $398.2 million last year, up 7.7% from the $369.6 million worth of compressors imported in 1984.

The positive balance of trade generated by refrigeration and air conditioning equipment amounted to $647 million in 1985, down $315.6 million or 32.8% from the $962.6 million trade balance recorded in 1984. The positive trade balance in 1981 amounted to $1.8 billion.

It must be remembered that these figures only represent shipments. They do not take into account the profits of U.S. companies from subsidiaries, joint ventures, and from licensing agreements that are not reinvested abroad.

Even though a major turnaround cannot be expected for at least 18 months, if then, there is hope that modest export improvements and a flattening of the upward import curve will result in stability within two years. One major U.S. company has indicated that it will discontinue much foreign sourcing and production when world markets and domestic availability and production costs permit.

In 1985, for the third year in a row, Canada was the leading export market for U.S. refrigeration and air conditioning products. The $534 million in exports to Canada, or 38% of the total, was a hair above the $530 million total in the previous year and the only growth area on the chart.

The Middle East, which had been the leading U.S. export market for many years, accounted for only 12% of the total in 1985 after slipping by 34% from $266 million in 1984 to $175.3 million last year. It had a 17% share of the total export market a year earlier.

Western Europe maintained a 16% share of U.S. exports in 1985 even though total exports to those markets declined by 18.7% from $290 million in 1984 to $235.8 million last year. The Far East absorbed $224.9 million in U.S. exports last year, down 8.9% from the $247 million in 1984, for a similar 16% share of total exports.

The Central and South American markets improved from a 13% to a 14% share despite the fact that total exports to those markets declined by 8.6% from $211 million in 1984 to $192.9 million last year. Africa, which dropped by 14.6% from $48 million in 1984 to $41 million last year, maintained its 3% share of U.S. exports.

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tinuing to work with the Bureau of the Census to reclassify refrigeration and air conditioning import and export categories to bring them more in line with the way domestic products are classified and with the Harmonized System (HS) that will become standard next year.

At present, import data are collected under the Tariff Schedule of the U.S. Annotated (TSUSA) and exports are classified under Schedule B of the Bureau of the Census. The new classification system is expected to more closely parallel Standard Industrial Code (SIC) 3585, Air Conditioning and Refrigeration Equipment, Including Warm Air Furnaces.

The promised round of world tariff negotiations, hoped for last year, still has not begun. In the meantime, Canada and the U.S. are seriously discussing the possibility of a free trade agreement that would eliminate most of the trade barriers between the two neighboring nations.

Imports

According to the Department of Commerce, eight nations accounted for 95% of the $766,766,254 worth of refrigeration and air conditioning equipment and parts imported into the U.S. in 1985. The total represents a 19.7% increase over the 1984 total of $640,481,168. The eight:

- **$453 million from Japan,** up 34.5% from $336.7 million in 1984, which mostly included 5.4 million compressors (up 10.2%) — including 1.33 million compressors 0.25 hp and under, 1.2 million compressors 0.25 to 1 hp, 1.66 million auto air conditioning compressors, and 199,000 compressors of from 1 to 3 hp — 115,500 room air conditioners, 4,500 heat pumps, 88,000 air conditioning condensing units, 4,000 refrigerators, 1,500 freezers, 12,500 absorption-type refrigerators, and $142 million in auto air conditioning parts. Japan accounted for 59% of U.S. imports.
- **$64.2 million from Italy,** down 8.2% from $69.9 million in 1984, which mostly included 1.26 million compressors of 0.25 hp and under, 292,000 compressors of from 0.25 to 1 hp, 263,000 compressors of from 1 to 3 hp, 2,600 refrigerators, 14,600 refrigerators, 19,400 chest freezers, and 1,800 freezer display cases.
- **$61.6 million from Canada,** down 11% from $69.2 million in 1984, which mostly included 350,500 compressors of 0.25 hp and under, 30,800 window or wall air conditioners, 7,400 refrigerators, 12,400 freezers, 9,600 absorption-type refrigerators, 6,700 chest freezers, and 2,000 freezer display cases.
- **$37.8 million from Brazil,** up 64.3% from $23 million in 1984, which mostly included 921,000 compressors of 0.25 hp and under, 73,000 compressors of from 0.25 to 1 hp, 7,100 ammonia compressors, 52,340 room air conditioners, and 1,200 refrigerators.
- **$36.5 million from Singapore,** down 10.8% from $40.9 million in 1984, which mostly included 591,000 compressors of 0.25 hp and under, 296,200 compressors of from 0.25 to 1 hp, and 45,800 window or wall air conditioners.
- **$28.8 million from Mexico,** up 50% from 19.2 million in 1984, which mostly included 16,100 compressors of 0.25 hp and under and $12.3 million in air conditioning machine parts.
- **$26 million from Sweden,** down 34.8% from $39.9 million in 1984, which mostly included 34 screw compressors and 59,000 absorption-type refrigerators.
- **$20.9 million from West Germany,** up 42.2% from $14.7 million in 1984, which mostly included 237,000 compressors of 0.25 hp and under, 136,400 compressors of from 0.25 to 1 hp, 197 screw compressors, and 8,000 auto air conditioning compressors.

In all, the U.S. imported $398.2 million worth of compressors last year, up 7.7% from the $369.6 million total for 1984 and 191.7% more than the $136.5 million total for 1982. Of those imported last year, $152.5 million represented compressors of 0.25 hp or less, $131.8 million were auto air conditioning compressors, and the value of compressors of from 0.25 to 1 hp was $83.7 million.

Several other countries, while they don't make the top eight, also had significant exports to the United States. They included Israel with 1,900 room air conditioners and 4,900 window or wall air conditioners. Malaysia shipped

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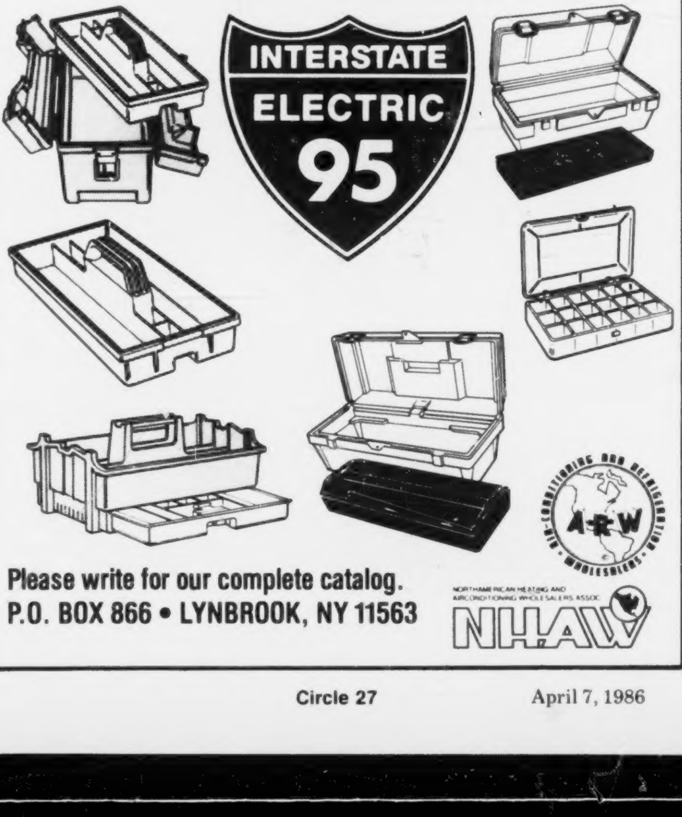

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FROM PRECEDING PAGE

4,500 window or wall air conditioners.

Korea exported 24,000 absorption-type refrigerators and 3,800 refrigerators to the U.S. The only significant Communist-bloc nation to export to the U.S. was Yugoslavia, which sent 6,700 chest freezers, 5,100 absorption-type freezers, 2,500 absorption refrigerators, and 1,200 display freezers.

Top exports

In terms of products exported from the U.S., the Department of Commerce's Bureau of the Census prepares country-by-country breakdowns for most of the product categories listed in the 10-year look at industry shipments found elsewhere in this issue. In most instances, it lists the total number of units shipped to each country and the total dollar value.

The U.S. was for many years the leading exporter of room air conditioners and traditionally shipped about 25% of production to foreign markets. It lost that leadership to Japan in 1981 and, last year, exported only 77,181 room air conditioners, or 2.6% of U.S. production. In 1984, the 126,648 room units exported represented 4% of total production. In 1982, U.S. firms exported 480,100 room units.

Although we do not have space to reprint the complete breakdowns, a feel for the top export markets of 1985 can be gained by looking at the top customer countries for key products expressed, unless otherwise indicated, in numbers of units. Here are a few:

- **Auto and truck refrigeration and air conditioning compressors** (200,538 units, down 29% from 282,591 units in 1984): West Germany 61,437; Canada 43,509; Brazil 30,375; Mexico 30,192; Britain 6,888; and Saudi Arabia 6,622.
- **Compressors of 3 hp and less** (453,596 units, down 28.4% from 633,616 units in 1984): Canada 181,685; Mexico 71,170; Venezuela 42,667; Saudi Arabia 34,088; Thailand 26,009; Nigeria 10,818; and Argentina 7,249.
- **Compressors of from 3 hp to 10 hp** (103,086 units, down 41.9% from 177,500 units in 1984): Mexico 42,721; Canada 9,597; Australia 8,678; Thailand 8,015; Venezuela 7,786; Malaysia 3,413; and Singapore 3,016.
- **Compressors of more than 10 hp** (30,229 units, down 33.5% from 45,449 units in 1984): Venezuela 6,810; Canada 2,855; France 2,542; Nigeria 2,535; Australia 2,118; and Saudi Arabia 1,457.
- **Ammonia compressors** (2,008 units, down 40.3% from 3,366 units in 1984): Canada 1,223; Panama 183; Korea 135; and the Bahamas 113.
- **Parts for refrigeration and air conditioning compressors** ($28.52 million, down 12.7% from $32.68 million in 1984): Belgium $4,198,385; Venezuela $4,119,767; Canada $3,668,241; Saudi Arabia $2,442,412; Australia $2,208,584; Mexico $1,969,630; and Holland $1,892,973.
- **Room air conditioners under 10,000 Btuh** (24,129 units, down 22.7% from 31,224 units in 1984): Canada 4,775; Arab Emirates 4,279; Mexico 2,385; Hong Kong 1,351; Saudi Arabia 1,056; Panama 983; and Holland 834.
- **Room air conditioners of from 10,000 Btuh through 17,000 Btuh** (29,523 units, down 39% from 48,500 units in 1984): Hong Kong 7,729; Saudi Arabia 4,273; Mexico 1,787; Qatar 1,395; Arab Emirates 1,368; and Liberia 1,224.
- **Room air conditioners of more than 17,000 Btuh** (23,529 units, down 49.8% from 46,920 units in 1984): Hong Kong 4,568; Arab Emirates 2,972; Canada 2,263; West Germany 1,220; Taiwan 1,163; and Ecuador 888.
- **Self-contained heat pumps 5 tons and under** (13,117 units, down 4.5% from 13,730 units in 1984): Canada 8,416; Australia 652; Mexico 561; Dominican Republic 479; Britain 437; and Arab Emirates 318.
- **Self-contained heat pumps of more than 5 tons** (2,667 units, up 67.7% from 1,590 units in 1984): Mexico 685; Canada 684; Australia 666; and Britain 115.
- **Split-system heat pumps** (13,209 units, down 36.8% from 20,900 units in 1984): Canada 8,518; Saudi Arabia 1,565; Japan 403; Britain 341; and Australia 222.
- **All-year heating-cooling packages 5 tons and under** (22,725 units, down 20.3% from 28,568 units in 1984): Canada 18,748; Mexico 1,456; Saudi Arabia 754; Libya 346; the Bahamas 256; and Britain 202.
- **All-year heating-cooling packages of more than 5 tons** (3,996 units, up 42.7% over 2,800 units in 1984): Canada 2,166; Holland 414; Britain 356; Hong Kong 340; and Saudi Arabia 302.
- **Self-contained air conditioners 5 tons and under** (23,077 units, down 15.3% from 27,250 units in 1984):

Major export markets

U.S. air conditioning, refrigeration equipment (values in millions)

Market	— 1981 —		— 1982 —		— 1983 —		— 1984 —		— 1985 —	
	Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Canada	401	19	352	19	422	27	530	33	534	38
Central, South America	363	18	285	16	180	12	211	13	193	14
Western Europe	315	15	323	18	277	18	290	18	236	16
Far East	314	15	297	16	242	15	247	15	225	16
Middle East	506	24	445	25	361	23	266	17	175	12
Africa	164	8	98	5	51	3	48	3	41	3
Other	10	1	1	1	33	2	11	1	10	1
Total	**2,073**	**100**	**1,802**	**100**	**1,566**	**100**	**1,603**	**100**	**1,414**	**100**

Canada 8,092; Saudi Arabia 2,351; Britain 1,775; Mexico 1,181; Kuwait 1,130; and Trinidad 629.

- **Self-contained air conditioners of more than 5 tons** (9,991 units, down 31.6% from 14,600 units in 1984): Canada 3,235; Saudi Arabia 1,805; Bahrain 546; Singapore 381; Ireland 380; and Australia 278.
- **Air conditioning condensing units under 5 tons** (36,740 units, down 52.2% from 76,800 units in 1984): Canada 12,693; Saudi Arabia 3,953; Panama 3,033; Colombia 1,796; Kuwait 1,160; Arab Emirates 1,048; and South Africa 1,006.
- **Air conditioning condensing units of more than 5 tons** (6,476 units, down 16.4% from 7,750 units in 1984): Saudi Arabia 1,711; Canada 980; Arab Emirates 916; Syria 546; Bahrain 361; and Venezuela 293.
- **Room fancoil units** (18,645 units, down 39.4% from 30,750 units in 1984): Canada 6,076; Arab Emirates 3,105; Saudi Arabia 2,976; Egypt 752; Kuwait 589; Jordan 574; and Japan 568.
- **Variable air volume terminal units** (11,602 units, down 4.9% from 12,200 units in 1984): Kuwait 3,019; Canada 1,921; Saudi Arabia 1,490; Israel 1,090; Portugal 598; and Yugoslavia 569.
- **Central station air handlers** (3,988 units, down 61.7% from 10,400 units in 1984): Saudi Arabia 1,425; Arab Emirates 369; Canada 322; Japan 187; Qatar 160; Hong Kong 140; and Singapore 124.
- **Centrifugal liquid chillers** (1,075 units, up 23.6% from 870 units in 1984): Canada 243; Taiwan 183; Hong Kong 142; Iraq 91; Thailand 56; Britain 52; and China 42.
- **Absorption liquid chillers** (49 units, down 56.6% from 113 units in 1984): Pakistan 15; Mexico 11; and Canada 7.
- **Reciprocating liquid chilling packages** (1,363 units, down 19.8% from 1,700 units in 1984): Saudi Arabia 476; Canada 275; Arab Emirates 122; Singapore 60; Kuwait 58; and Venezuela 40.
- Of the $209.1 million worth of **air conditioning machinery and parts,** down 13.3% from $241.3 million in 1984, Saudi Arabia accounted for $41.6 million; Canada $26.3 million; Mexico $13.6 million; France $11.2 million; Venezuela $6.3 million; Britain $5.9 million; West Germany $5.6 million; Australia $5.3 million; Japan $4.8 million; and Belgium $4.2 million.
- **Ice-making machines** (16,287 units, up 5% from 15,500 units in 1984): Canada 7,538; Mexico 893; Japan 740; Britain 488; Taiwan 484; Singapore 442; Haiti 349; and Sweden 314.
- **Drinking water coolers** (78,502 units. Total for 1984 not available): Saudi Arabia 34,564; Canada 28,956; Kuwait 1,275; Britain 1,188; the Bahamas 1,040; Italy 1,028; and Sweden 1,028.
- **Refrigerated self-contained enclosures** (18,141 units, down 9.3% from 20,000 units in 1984): Canada 4,544; Saudi Arabia 1,505; Britain

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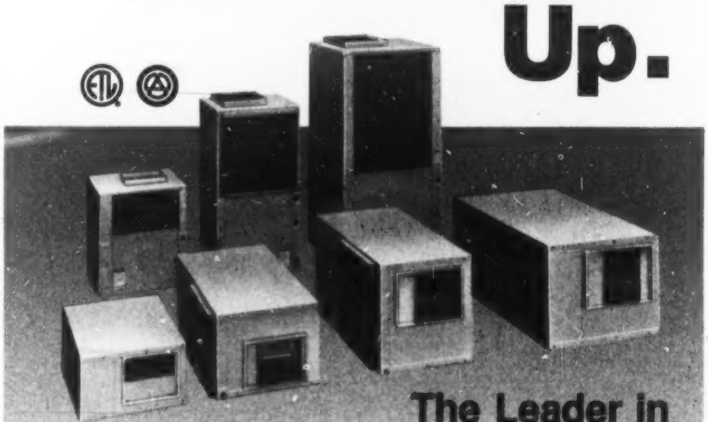

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INTERNATIONAL

FROM PRECEDING PAGE

1,203; Hong Kong 1,193; Egypt 1,154; and Lebanon 835.

- **Refrigerated enclosures, commercial type** (7,978 units, down 37.7% from 12,800 units in 1984): Britain 1,604; Mexico 999; Canada 996; Japan 532; and Trinidad 418.

Heating Equipment

Although information from the Department of Commerce is limited, we thought we would share what we could obtain. As the reader will see, 1984 export figures were not available for comparison purposes.

For the scope of the products contained below, U.S. heating equipment and parts exports in 1985 totaled $91,302,333. Imports of heating equipment and parts into the U.S. last year totaled $173,506,515, up 29.8% from the $133,642,604 total in 1984. Exports accounted for only 52.6% of imports for a negative trade balance of $82,204,190.

The leading export markets were Canada ($35,279,785); Mexico ($7,061,712); Japan ($5,310,301); West Germany ($4,781,482); Saudi Arabia ($4,095,885); and Britain ($3,531,060).

The U.S. was a prime market for imports from Japan ($61,890,437); Canada ($29,505,475); Taiwan ($28,537,826); West Germany ($11,712,102); Britain ($9,050,654); and Korea ($3,865,730).

Imports

The imports and import leaders:

Fireplace grates ($2,197,824, down 15% from $2,585,957 in 1984): Taiwan $1,729,673; and China $238,518.

Cast iron stoves and parts ($20,522,003, up 14.5% from $17,925,733 in 1984): Taiwan $7,950,063; Norway $2,755,588; Canada $2,174,996; West Germany $2,042,933; and Belgium $1,658,811.

Solid fuel heating apparatus (114,533 units, up 96.4% from 58,319 units in 1984): Japan 30,201; Canada 23,819; Taiwan 23,427; New Zealand 13,626; and Korea 11,000.

Other nonelectric heating apparatus (1,756,570 units, up 41.2% from 1,244,105 units in 1984): Japan 1,198,967; Korea 161,980; Taiwan 133,245; Canada 61,027; Britain 59,264; and Spain 53,607.

Stove and heater parts ($35,967,844, up 16.4% from $30,904,449 in 1984): Taiwan $15,979,392; Canada $3,390,817; Japan $3,500,940; Korea $3,123,242; Hong Kong $2,075,301; and China $2,016,296.

Furnace burners and parts ($13,187,238, up 39.6% from $9,446,232 in 1984): West Germany $7,402,310; Canada $1,964,224; Japan $1,064,042; Britain $995,388; and France $315,995.

Heating exports

Following are the leading export markets for U.S. heating equipment and parts:

- **Domestic heating stoves** (108,089 units in 1985): Canada 93,009; Britain 3,502; Australia 3,407; and Korea 2,595.
- **Oil and gas burners for central heating** (19,046 units in 1985): Korea 3,359; Chile 3,347; Belgium 1,896; Britain 1,464; Dominican Republic 1,440; Colombia 1,124; and Ecuador 1,027.
- **Other heating equipment** ($14,483,453 worth in 1985): Canada $7,754,672; Saudi Arabia $714,895; Japan $706,195; West Germany $661,884; Britain $490,388; and Mexico $477,556.
- **Heating parts** ($22,366,948 worth in 1985): Canada $12,072,424; Mexico $2,105,342; Britain $933,938; Holland $841,705; Australia $757,796; Pakistan $582,521; Saudi Arabia $531,519; and Colombia $520,816.
- **Oil burners** (14,398 units in 1985): Korea 3,652; Canada 2,954; and Britain 814.
- **Gas burners** (14,454 units in 1985): Canada 5,003; Japan 2,624; Belgium 1,684; Australia 1,201; and Mexico 795.
- **Other industrial burners** ($29,717,149 worth in 1985): Canada $4,592,382; West Germany $3,410,044; Mexico $3,008,762; Saudi Arabia $2,785,998; Japan $2,629,443; and China $2,521,520.

WHOLESALERS

Air conditioning and refrigeration parts-and-supplies wholesalers report that business in 1986 will improve over last year's total volume by about 9%, according to a forecast by 49 members of the Air-conditioning and Refrigeration Wholesalers (ARW).

The forecast varies for the five regions of the U.S. from a gain of only 5.5% in the Northeast and 7.7% in the Midwest to 10.1% in the Southeast and 11.5% in the Southwest. The anticipated gain for the West is 9.3%.

Wholesalers expect inflation this year to run about 3.4%.

Over past years they have kept a record of how their forecasts have compared to actual experience. For the previous five years, here are the forecasts with the actual sales performance for that year in parentheses: 1984 9.5% (14.1%); 1983 11.5% (12.6%); 1982 7.4% (2.2%); 1981 10.2% (8.5%); and 1980 14% (10%).

Because ARW wholesalers are traditionally oriented toward parts and pieces, their business depends much more on the number of system repairs being made in a given year than on the much more volatile equipment market. For this reason, ARW members tend to experience flat sales during recessions rather than declines.

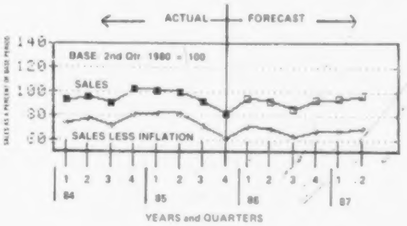
For example, when unitary shipments declined by 21% in 1982, ARW member volume increased by 2.2% and, when unitary shipments rebounded by 43% a year later, the increase for ARW wholesalers was a much more modest 12.6%.

Looking across the national forecasts, there are no anticipated sharp gains. The strongest prospects, with about a 7% increase, are refrigeration condensing units, refrigeration coils, replacement compressors, capacitors, and refrigerant flow and electrical controls.

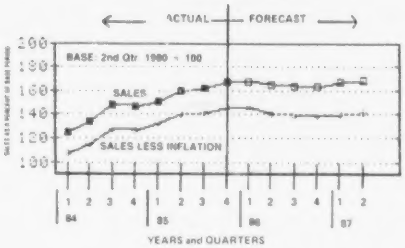
At the low end of the spectrum are grilles, registers, and diffusers, pipe and tubing insulation, air filters and

NHAW forecast

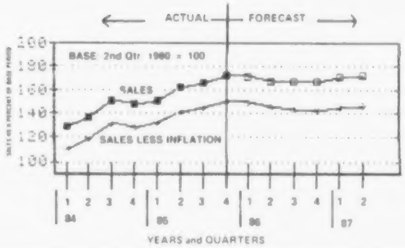
Air conditioning



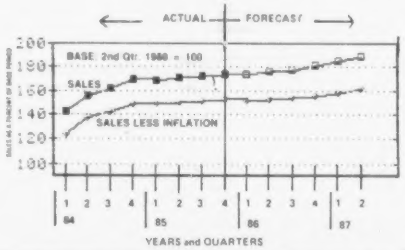
Refrigeration



Controls



Sheet metal



cleaners, and water treatment and maintenance chemicals — all items that reflect their interest in those markets as much as they reflect market activity.

On a regional basis, however, wholesalers in the Southeast anticipate an 18% increase in refrigerant flow control business, a 12% increase in electrical controls and almost as much in electric motor replacements, and a 10.2% increase in replacement compressors.

Wholesalers in the Southwest and West expect 10% to 12% increases in the sales of refrigeration condensing units and refrigeration coils. Electric motors, too, present a strong market in 1986. But refrigerant flow controls, with only a 2.2% increase in the Southwest and a 3% drop in the West, are at the low end of the scale.

The Northeast, which has rebounded strongly in the last two years, is only expected to improve by 5.5% this year. Only marginal improvements are expected in all categories with the exception of refrigerant sales, which are expected to decline by 3.2%. The Midwest will fare a bit better with an 8.9% increase in replacement compressors and a 7.8% improvement in driers,

TURN TO PAGE 123

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WHOLESALERS

Percent of dollar value potential for 1986 vs 1985

Product	Northeast	Southeast	Central	Southwest	West	Total U.S.	Canada
Unitary AC&H equipment (4 tons and under)	0.8	7.9	4.2	7.2	—	5.5	3.8
Unitary AC&H equipment (over 4 tons)	1.3	6.3	4.7	8.9	–	5.5	3.2
Refrigeration condensing units	1.7	6.3	6.9	12.2	10.0	7.1	6.3
Refrigeration coils	1.9	6.0	6.7	12.2	10.6	7.1	7.4
Replacement compressors	2.0	10.2	8.9	4.6	6.1	7.5	3.2
Refrigerant	-3.2	0.8	6.3	6.6	1.4	2.7	2.7
Driers, strainers, filters, and sight glasses	1.8	7.8	7.8	7.6	2.0	6.5	5.8
Refrigerant flow controls — TEV, solenoid, regulating valves, etc.	1.2	18.2	6.1	2.2	-3.0	7.1	5.3
Pressure and temperature controls	1.4	8.6	4.6	4.8	5.7	5.3	3.4
Electrical controls — relays, contactors and starters	2.1	12.0	4.7	4.5	5.4	7.0	3.9
Capacitors	1.8	9.9	5.4	5.1	9.5	6.8	4.4
Electric motors	2.7	11.9	3.4	9.1	10.0	7.7	7.0
Pipe and tubing fittings	0.6	3.6	3.9	5.2	1.6	3.4	8.5
Pipe and tubing insulation	0.6	0.6	3.8	4.9	1.6	2.1	7.7
Grilles, registers, and diffusers	—	-0.2	3.0	6.4	—	2.0	3.6
Sheet metal and fittings	—	1.6	3.9	4.2	—	2.9	8.8
Air filters and air cleaners	0.7	2.2	3.4	3.0	2.5	2.5	4.1
Water treatment and maintenance chemicals	0.4	2.3	3.0	4.1	4.7	2.7	3.0
Instruments and test equipment	1.7	4.9	4.5	3.8	1.1	3.7	3.7
Totals	**5.5**	**10.1**	**7.7**	**11.5**	**9.3**	**9.0**	**10.8**

1986 SALES FORECAST undertaken by members of the Air-conditioning and Refrigeration Wholesalers (ARW) shows an overall gain of 9% in dollar volume over 1985. A total of 49 firms submitted data. The figures represent the weighted average (by sales volume) of all responses. Total sales represent the arithmetic average of all wholesaler estimates of 1986 total sales and are not an aggregate of the product categories.

FROM PAGE 121

strainers, and sight glasses.

Canadian sales in 1986 are expected to increase by 10.8%, according to the reports of 10 wholesalers north of the border. They expect inflation will be about 3.6% (average) or 4% (median).

Sheet metal and fittings, with an 8.8% increase, will lead Canadian sales. Following closely are pipe and tubing fittings (8.5%), pipe and tubing insulation (7.7%), and electric motors (7%). Refrigeration coils, at 7.4%, and refrigeration condensing units (6.3%) also are expected to do well.

ARW reported that the 1986 survey was conducted with the assistance of consultants from the Profit Planning Group, Boulder, Colo., who worked with ARW's Marketing and Statistical Committee.

NHAW

Members of the Northamerican Heating and Airconditioning Wholesalers Association (NHAW) use a three-year forecast, revised each quarter, for five key product groups: air conditioning, refrigeration, controls, sheet metal, and plumbing. The air conditioning category includes warm air and radiant heating equipment as well as heat pumps, humidifiers, filters, and air solar heating panels. The plumbing category includes liquid solar collectors.

For the NHAW outlook in chart form, see the accompanying charts on page 121. The second quarter of 1980 has been used for the base period, or "100," on the charts. The top line represents seasonally adjusted sales levels and the bottom line, because it's adjusted for inflation, is essentially a forecast of unit sales.

The forecast is prepared for NHAW by William Spooner and Associates, Inc., using an econometric model maintained by the University of California-Los Angeles (UCLA) and sales data supplied by NHAW members.

For 1985, members of NHAW experienced the following dollar sales changes over the previous year's experience: air conditioning down 2.2%; controls up 10.6%; plumbing up 15.2%; refrigeration up 15.7%; and sheet metal up 8%. Total dollar sales increase for all categories was 7.35%.

In its first quarterly forecast for 1986, NHAW is forecasting some growth in the residential, commercial, and industrial markets — but less growth than that experienced in 1985. Its dollar sales outlook for 1986: air conditioning down 5%; controls up 8%; plumbing up 10%; refrigeration up 3%; and sheet metal up 3%.

Looking ahead even further, air conditioning is expected to increase by 9% in 1987 and by 5% in 1988. Sales of controls: up 4% in 1987 and up 6% in 1988. Plumbing should be up 8% in 1987 and 3% in 1988. Refrigeration sales should increase by 3% in 1987 and twice that much a year later. And sheet metal sales are forecast to increase by 7% in 1987, 6% in 1988.

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Circle 63

THE REPLACEMENT MARKET

In the dynamic replacement market, those who attempt to describe it have to be careful to also specify what segment they're talking about.

At least the way we see it, replacements last year ran the gamut from 17.5% of shipments for residential air-to-air heat pumps to 88% of shipments for oil-fired furnaces. Other product categories stood at various points in between, some more or less static and others moving upward.

In a maturing industry, a strong replacement market is a two-edged sword. It means that a relatively large increase in new construction usually will not affect the total greatly. But when construction slows, replacement sales keep the bottom from falling out of the market.

But when new construction is down, replacement sales do not always strengthen. This was the case in the early 1980's when the recession, coupled with extremely high interest rates, caused a severe drop in both the new construction and replacement-renovation markets. In fact, many homeowners put off repairing cooling system breakdowns near the end of the season because of interest rates and employment uncertainty.

There is no doubt that in today's business climate, however, that contractors are increasingly gearing their operations to take advantage of the surge in replacement business. For most, this means paying much more attention to service — the gateway to most replacement-renovation sales — and ways to help owners upgrade their comfort heating-cooling systems.

Before looking at individual industry markets, it might be well to look at national total expenditures for alterations and repairs as determined by the Bureau of the Census and the Bureau of Labor Statistics. Their survey covers 51.3 million owner-occupied housing units and 14.7 million rental properties.

Total expenditures for 1984, the latest year for which figures are available, amounted to $63.174 billion, up 28.2% from the total of $49.295 billion in the previous year.

Heating and air conditioning repairs and alterations accounted for almost 10% of that total. Significantly, the $6.265 billion for heating and air conditioning in 1984 represented a 68.7% improvement over the $3.714 billion total for 1983.

We think there are two basic reasons for the sharp increase. Not only was the economy moving out of the latest recession, but an increasing number of homeowners were electing to upgrade their heating and cooling systems for reasons of efficiency.

The breakdown tends to bear out this argument. Of the heating and air conditioning total, the $1.243 billion in maintenance improvements (up 25.4% from $991 million in 1983) accounted for only 20% of the total.

The other 80% of the total, $5.023 billion, was represented by construction improvements. This category improved by 84.5% over the $2.723 billion total in 1983. Breaking this total down further, $961 million were additions and alterations while $4.062 billion represented major replacements, up 100% over the $2.022 billion total in the previous year.

Significantly, 95.5% of the major replacements were handled by contractors. Only 4.5% of the dollar volume was represented by do-it-yourselfers.

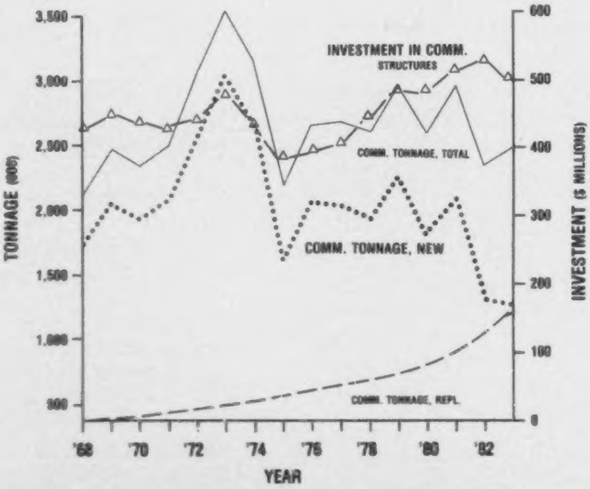
On a regional basis, 15.4% of the work was done in the Northeast, 35.5% in the Midwest, 30.4% in the South, and 18.7% in the West.

For contractors interested in breaking down their local markets, only 4.6% of the total involved houses built from 1980 to 1984. For homes built from 1970 through 1979 it was 18.3%; 1960 through 1969 it was 26.8%; 1950 through 1959 it was 20.3%; 1940 through 1949 it was 19.4%; and for homes built before 1940 it was 10.6%.

American households were expected to have spent $75 billion on residential alterations and repairs in 1985, according to the National Association of Home Builders (NAHB). Of the overall market, NAHB estimates that 75% of the work was done by contractors and 25% consisted of do-it-yourself projects.

A 1985 National Remodelors Council economic survey revealed that 55% considered residential remodeling their most important business activity, 21% listed custom home building, and 11% listed commercial remodeling.

According to comments from those responding to the survey, however, there is a feeling that the repairs and alterations market is expanding too rapidly and that too many unlicensed



NEW AND REPLACEMENT commercial central air conditioning installations, showing tonnage and investment for the years 1968 through 1983, was prepared by Kenneth E. Hickman, vice president, research and advanced engineering, York Air Conditioning.

firms are underbidding their licensed counterparts.

A consumer survey of 4,500 homeowners conducted by NAHB in 1985 revealed that, in the previous year, 10.1% had changed their water heater, 9.9% had remodeled their kitchen, 9.4% had put on a new roof, 6% had changed their heating system, 4.9% had finished their basement, 4.8% had changed or added air conditioning, and 3.7% had added or changed the siding on their homes.

In a similar survey conducted in 1980, energy efficiency was listed by 80% of homeowners as the most important consideration if they had to move again. Five years later energy efficiency was again the number one consideration — but with only 68% of homeowners.

Air conditioning

In the case of unitary air conditioning, the replacement market must be separated into three parts: home comfort cooling, heat pumps, and commercial.

If we subtract 820,623 heat pumps from the 1985 unitary shipment total, we get 2,469,887 comfort cooling units — of which 2,000,608, or 81%, were residential and 469,279 units, or 19%, were commercial.

This split was selected because it matched the determination of the Air-Conditioning and Refrigeration Institute (ARI) for 1984, the latest year for which the split was available. (If you're comparing this split with the one found in the section of air conditioning, remember that this one does not include heat pumps).

Of the 2,000,608 residential cooling units shipped in 1985, we estimate that 736,100, or 36.8%, went into new construction (423,083 into single-family homes and 313,017 into multifamily units). These figures are arrived at by multiplying known penetration rates for air conditioning by the known number of housing starts and subtracting the known number of heat pumps.

Looking back at the revised total of 814,582 comfort cooling units we estimated were installed in new homes in 1984, the 9.6% drop is only partly accounted for by the marginal drop in housing starts. Most of the shift, we feel, is accountable by the increased use of heat pumps in multifamily units.

The other residential cooling units break down this way: 909,417 units, or 45.5%, were replacements (up from a 43% share in 1984); 300,091, or 15%, were add-on units; 40,000 units, or 2%, went into new mobile homes; and 15,000 units, or 0.7%, were mobile home replacements.

There is no doubt, as discussed in "Comfort in construction," that the driving force of 50 electric utilities offering rebates based on efficiency has had the effect of improving the replacement market at a pace even faster than the already fast-expanding market of 12- to 15-year-old units due for replacement. Add in a relatively stable economy, more reasonable interest rates, and some hot weather and the promise is for strong replacement sales for the forseeable future.

Looking ahead, we feel that cooling-only units going into new homes, at 745,600 in 1986, will be slightly ahead of the 1985 pace. Similar marginal improvements will be true for add-ons and mobile homes. Replacements this year should top 920,000 units, or as much as one million if hot weather strikes early in the season.

Commercial

According to figures developed by Kenneth E. Hickman, vice president, research and advanced engineering, York Heating and Air Conditioning, about half of the replacement air conditioners go into the South, 25% into the Midwest, and the remainder are equally divided between the Northeast and West.

Of the estimated 469,279 commercial unitary systems shipped last year, we estimate that about half went into new construction and half were replacements. Hickman reports that, of all heating-cooling packages, gas heat is used by a margin of 4 to 1 over electric strip heat and by a margin of 6 to 1 over heat pump systems. The exception is the South, where electric strip (resistance) heat is more common than gas heat.

Hickman estimates that, in terms of total tonnage, new and replacement commercial air conditioning systems

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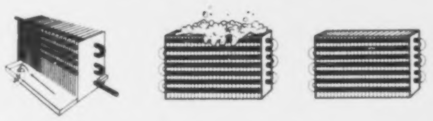
THE PROBLEM SOLVERS FROM SEER—PART 1



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first equalled one another in 1983. The total was about 2,800 tons. We feel that, since that time, replacement chillers now outnumber new chiller installations by a slight margin and that packaged, or unitary, systems only reached equilibrium within the past year.

Heat pumps

In the case of the 738,561 residential heat pumps we estimate were shipped last year (90% of shipments), it would appear that 589,144 went into new construction (326,104 into single-family homes, 263,040 into multifamily units). This represents only a 5.6% increase over the revised total of 558,150 heat pumps for this market segment a year earlier.

Of the remaining residential heat pumps, we estimate that 15,000 were add-on units (including fossil fuel-fired furnaces), 5,000 went into mobile or manufactured homes, and 129,417 were replacements (17.5% of residential shipments). That's a 39.2% increase from the 92,925 residential replacements (13.8% of residential shipments) in 1984.

In terms of commercial heat pumps, we think 73,806 units, or 90% of the 82,062 total, went into new installations and only 10%, or 8,206 units, were replacements. These figures are in reasonable agreement with those developed for the "Air conditioning" section to indicate the commercial rooftop market. It must be noted that both sets of figures depend on arbitrary judgements.

Add-ons

The add-on market for residential comfort cooling, fed by the desire of homeowners for the comfort of central air conditioning without the need to buy another home, once led replacements by a wide margin. But as the market has matured, the number of add-on units keeps diminishing.

For example, as late as 1981 add-ons had an estimated 29% market share. We believe this share has slipped to somewhere between 12% and 15% for the past three years.

In years when new home construction is down, the number of add-ons tends to be higher than in years, such as the last three, when home construction is up. However, we feel this market, though small in relation to new construction and replacements, has reached a minimum that will characterize it for several years to come.

A new driving force for the add-on market is the trend for more and more homeowners to replace old furnaces for reasons of efficiency. Although it's reasonable to expect that many already had comfort cooling — and may have replaced that for efficiency reasons as well — it's also reasonable to assume that some did not have air conditioning.

Because the contractor who installed the new furnace also probably offered air conditioning, it's probable that this relatively new market development was of indirect benefit to the add-on cooling market.

We cannot, however, quantify this reversal of a past phenomenon in which many homeowners were influenced to buy a new furnace when they added central cooling.

Boilers

Of the 305,224 residential boilers shipped in 1985, we estimate that only 45,825 went into new single-family homes. When about 6,000 boilers for new multifamily homes are taken into account, the total comes to 51,825, or 17% of shipments.

The other 253,400 units, or 83%, were replacements.

In passing, it might be noted that the gas conversion phenomenon, which distorted residential gas boiler shipments at the turn of the decade, is long over. Today's market is on a more normal footing and oil-fired units have regained most of the ground they lost during the conversion war.

Furnaces

Of the 147,260 residential oil furnaces shipped last year, we estimate that 18,000, or 12.2%, went into new single- and multifamily homes. This means that 129,300 oil furnaces, or 87.8%, were replacements.

Not to be forgotten, either, should be the 258,000 replacement oil burners shipped in 1985, according to Fuel Oil/Oil Heat and Solar Systems. The magazine estimates that 80% of these were retention-head or other high-efficiency types.

Of the 1,822,295 residential gas furnaces shipped in 1985, we estimate that 633,450 (35%) went into new single- and multifamily homes, 130,200 (7.1%) went into new mobile or manufactured homes, 50,000 (2.7%) were conversions from other fuels, and 1,008,645 (55.2%) were replacement units.

Efficiency

Importantly, actions by homeowners anxious to control rising fuel bills have resulted in the development of a whole new market within the past four years — a market that centers around the replacement of inefficient equipment in good working order for the sake of efficiency.

For example, the inefficient (below 65% annual fuel utilization efficiency) atmospheric gas furnaces that represented almost the whole market only five years ago had shrunk to a 19.1% market share and 14.9% in 1985. (See "Comfort in construction".)

At the other end of the spectrum, 574,595 gas furnaces shipped in 1984, or 31% of the total, had AFUE's of 80% or better. Last year the total had risen to 568,955 units, or 31.3% of the total. Most of these were replacements.

Similarly, the Gas Appliance Manufacturers Association (GAMA) also reported that 32.2% of oil furnaces shipped in 1984, or 47,645 units, had AFUE's of 80% or more. Last year 34.9% of oil furnaces shipped, or 51,340 units, had AFUE's of 80% or better.

The effect of the dramatic decrease in world oil prices, the more modest drop in natural gas prices in some markets, and the homeowner's perception of future energy price increases still is not known. But there are signs that replacements for the sake of efficiency, especially in the case of heating equipment, may be waning.

Not only have the prices of oil and gas stopped escalating at the steep rates of the past, they are showing strong signs that future increases will be modest at least for the next five years. When that realization is absorbed by the public, we suspect it will become increasingly difficult to sell efficiency for efficiency's sake in many markets.

This is not likely to be the case, however, for air conditioning and heat pumps. Electric rates already are high and, while they are expected to escalate modestly in future, they are already taking their toll on energy bills, particularly in the South. Too, the utility incentive programs are likely to continue in many markets as the utilities try to reduce future generating capacity requirements.

Bureau of the Census data

A 10-year look at air conditioning and refrigeration unit shipments

Product	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Condensing units	334,679	417,286	529,515	537,082	497,833	455,695	439,714	379,787	458,538	440,388
Compressors and compressor units	19,240,243	22,761,950	23,991,643	25,790,862	24,970,111	19,829,319	21,233,348	17,433,817	20,690,897	22,889,102
Ammonia compressors	**1,449**	**1,453**	**1,443**	**1,819**	**2,014**	**1,860**	**1,808**	**1,509**	**1,173**	**1,233**
Screw compressors[1]	—	—	—	—	—	**5,809**	**5,320**	**2,620**	**3,601**	—
Fancoil units[2]	200,807	193,587	198,939	186,827	178,719	245,127	253,832	207,232	214,799	209,001
Induction units[3]	42,636	21,112	—	—	—	33,343	—	—	—	—
Central-station air handlers	**47,691**	**48,616**	**52,371**	**52,441**	**60,266**	**60,841**	**59,866**	**58,961**	**56,301**	**53,432**
Unitary air conditioners[4]	**1,561,385**	**2,399,638**	**2,829,447**	**3,226,998**	**3,057,009**	**1,881,465**	**1,991,507**	**1,568,838**	**2,067,152**	**2,600,981**
Unitary heat pumps (air-to-air)	160,485	320,043	536,558	371,436	646,926	508,457	604,903	408,742	660,956	803,126
Water-source heat pumps[1]	—	—	—	—	—	69,931	69,689	86,092	69,280	86,165
Packaged terminal air conditioners	**189,927**	**182,608**	**261,777**	**148,332**	**183,274**	**143,212**	**143,427**	**135,741**	**150,073**	**184,780**
Packaged terminal heat pumps[1]	—	—	—	—	—	—	**32,439**	**52,512**	**58,753**	**93,549**
Room air conditioners	2,648,430	2,805,124	3,303,335	4,030,423	3,757,102	3,178,993	3,722,509	2,883,156	1,888,075	3,039,491
Centrifugal chillers[5]	4,647	2,994	2,977	2,975	3,141	4,200	3,938	3,893	4,089	—
Reciprocating chillers	**9,279**	**7,114**	**8,665**	**9,003**	**9,695**	**12,325**	**12,090**	**11,668**	**10,533**	**13,763**
Absorption chillers	**740**	**571**	**588**	**470**	**392**	**279**	**239**	**199**	**135**	**153**
Adsorption, open-type absorption	1,672	1,866	2,318	2,704	2,503	2,962	3,171	1,461	1,044	1,087
Cooling towers[2]	13,212	11,156	8,517	9,906	—	12,185	15,381	11,222	11,344	10,853
Evaporative condensers	**2,764**	**2,094**	**2,299**	**2,453**	**3,263**	**2,881**	**2,859**	**2,166**	**2,149**	**2,678**
Mobile vehicle air conditioners	**9,137,453**	**11,978,679**	**9,459,535**	**9,074,932**	**7,651,198**	**5,852,328**	**6,059,342**	**5,651,329**	**9,267,612**	**12,232,621**
Mobile air conditioners for trucks, agricultural, construction equipment	1,412,508	2,320,911	2,452,820	1,298,198	1,352,198	764,942	834,174	1,064,381	1,557,060	1,948,655
Mobile vehicle refrigeration systems[6]	63,864	70,836	76,536	70,731	76,395	60,301	66,773	68,843	66,502	28,450
Recreational vehicle air conditioners[1]	—	—	—	—	—	**93,919**	**119,566**	**142,227**	**156,689**	**173,914**
Unit coolers[7]	**161,287**	**195,738**	**197,975**	**194,905**	**187,434**	**175,371**	**169,487**	**163,697**	**187,612**	**179,726**
Ice-making machines	128,288	187,887	165,106	194,049	218,827	166,725	165,626	150,475	166,399	218,281
Drinking water coolers	262,173	307,570	335,173	373,885	411,687	409,782	432,733	373,560	429,258	528,093
Dehumidifiers	**525,407**	**502,141**	**351,188**	**477,692**	**728,148**	**734,738**	**540,386**	**438,833**	**610,013**	**861,323**
Humidifiers (central and self-contained)[1]	—	—	—	—	—	**423,986**	**396,413**	**310,342**	**324,948**	**427,198**

Source: Bureau of the Census Current Industrial Reports MA-35M, Air-Conditioning and Refrigeration Equipment, including Warm Air Furnaces. [1]New category since 1980. [2]Excludes vertical stack units in 1977. [3]Withheld to avoid disclosing operations of individual companies. [4]For years 1980 through 1983, add these figures to those for unitary heat pumps (air-to-air) and subtract exports from that total to get comparable industry figures. [5]Excludes open-type units for 1978 and succeeding years. [6]Excludes railway freight cars for 1978 and succeeding years. [7]Excludes floor-mounted dry and spray types for 1979 and succeeding years.

FUEL AND ENERGY

United States energy consumption for the first 11 months of 1985 was 66.994 quadrillion Btu (quads), down 0.76% from the 67.511 quads consumed in the same 11 months of 1984 but up 3.8% from the 64.518 quads consumed in the same period of 1982.

The Department of Energy's Energy Information Administration (EIA), which reports these data, has run late for the past three years. It's no longer possible to provide full calendar year statistics in all categories. The total energy consumed in the U.S. in 1984, the last year for which 12-month data is available, was almost on a par (74.108 quads) with the 74.282 quads consumed in 1973, the year of the Arab oil embargo.

In the residential-commercial sector (EIA lumps them together), the 23.8 quads consumed during the first 11 months of 1985 was 0.5% more than the 23.684 quads consumed by this sector in the same period a year earlier. The 1984 full-year total of 26.299 quads represents an 8.9% increase over the 24.142 quads used by the residential-commercial sector in 1973.

During the first 11 months of 1985, this sector represented a 35.5% share of total energy consumption, up from the 34.89% share for the same period in 1984 but still below the 37.05% share for the first 11 months of 1982.

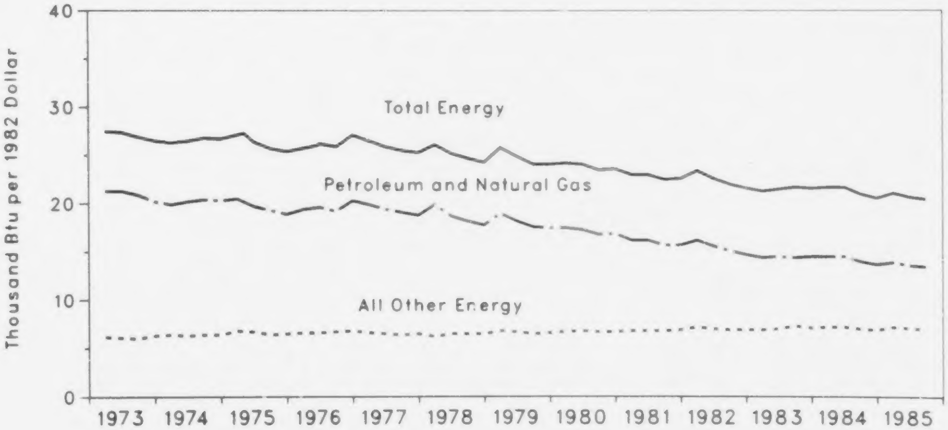
Industrial sector consumption of 24.887 quads for the first 11 months of 1985 was down 2.4% from 25.501 quads consumed by this sector in the same period of 1984. It represents a 5.5% increase over the 23.585 quads consumed in the first 11 months of 1983. The 1984 full-year total of 27.921 quads was 11.5% lower than the 31.537 quads consumed by the industrial sector in 1973.

During the first 11 months of 1985, the industrial sector represented a 37.12% share of total energy consumption, down slightly from the 38.33% share for the same period in 1984.

For the record, the transportation sector consumed 18.282 quads of energy during the first 11 months of 1985, up a hair from the 18.256 quads consumed during the same period a year earlier. It represented a 23.3% share of total energy consumption in 1985. The share in 1973 was 25%.

Electric utilities consumed 24.198 quads of energy during the first 11 months of 1985, up 1.6% from the 23.824 quads consumed by electric utilities during the same period in 1984 and 8.8% more than the 22.237 quads consumed during the first 11 months of 1982. The 1984 full-year total of 25.98 quads was 30.9% higher than the total of 19.852 quads consumed in 1973.

Of the 26.299 quads consumed by the residential-commercial sector during



Quarterly Energy Consumption per Dollar of Gross National Product
(Seasonally Adjusted)

the first 11 months of 1985 (with the share for the same period a year earlier in parentheses), only 0.66% (0.8%) was coal; 25.4% (27%) was natural gas; 9% (9.2%) was petroleum; 19.3% (18.9%) was electricity; and 45.6% (44.1%) was electricity generation and transmission losses.

Similarly, the 24.887 quads used by the industrial sector in the first 11 months of 1985, with the 1984 share in parentheses, broke down this way: 10.3% (10.1%) coal; 25.6% (26.3%) natural gas; 29% (28.8%) petroleum; 0.12% (0.12%) hydroelectric power; 0.05% (0.04%) net imports of coal and coke; 10.4% (10.4%) electricity; and 24.6% (24.2%) electricity generation and transmission losses.

Conservation

In order to get a gross measure of conservation, DOE records show that it took 27,100 Btu to generate each 1982 constant dollar of gross national product (GNP) in 1973. In the third quarter of 1985, it took only 20,500 Btu to generate a constant dollar of GNP, or 24.4% less than in 1973.

In simple terms, this means that the U.S. economy in the third quarter of 1985 produced at the rate of 3.584 trillion constant 1982 dollars worth of goods and services with 24.4% greater energy efficiency than in 1973. Had it not been for this improvement in efficiency over a 12-year period, U.S. energy consumption would have been at a rate of 91.28 quads in the third quarter of 1985 instead of the actual 73.373 quads.

Fuel costs

The average price of No. 2 fuel oil for U.S. homes in November, 1985, was $1.119/gallon, excluding taxes, up 6.4% from the $1.052/gallon in November, 1984. It also represents a 6% drop from the $1.194/gallon paid in November, 1981. The residential cost of No. 2 fuel oil in 1978, just before the second oil price shock, was 49 cents/gallon.

In November, 1985, the price of a gallon of No. 2 fuel oil to homes ranged from 99.7 cents in Pittsburgh, Pa., and 99.5 cents in Portland, Ore., to $1.068 in Baltimore, Md., and $1.141 in the District of Columbia, according to EIA figures.

Average residential natural gas prices in the U.S. declined by 2.6% from $6.09/1,000 cu ft in November, 1984, to $5.93/1,000 cu ft in November, 1985. It should be remembered, however, that the November, 1985, price was 61% higher than the $3.68/1,000 cu ft average price in 1980 and 360% higher than the $1.29/1,000 cu ft average in 1973.

In the case of specific cities, EIA reported that, in November, 1985, the price of natural gas expressed in dollars/100 therms ranged from $31.56 in Anchorage, Alaska, and $44.14 in Houston to $72.69 in Philadephia and $147.50 in Honolulu, Hawaii, where the only gas available is synthetic or LNG (liquefied natural gas).

In October, 1985, the latest date for which EIA data were available, the average price of natural gas to industrial users was $3.99/1,000 cu ft, down 1.7% from $4.06/1,000 cu ft in the same month a year earlier. The price of industrial natural gas, however, has increased by 159% from $1.54/1,000 cu ft in 1978. Prices for 1973 were not available.

The average price charged residential customers by privately owned electric utilities in November, 1985, was 7.73 cents/kWh, up 1.4% from the 7.62 cents/kWh charged in November, 1984. The 1985 price was 79.4% higher than the 4.31 cents/kWh charged in 1978 and 204% higher than the 2.54 cents/kWh charged in 1973.

The average price privately owned electric utilities charged commercial customers in November, 1985, was 7.49 cents/kWh, up 0.8% from the 7.43 cents/kWh charged in November, 1984. The 1985 price represented a 71.8% increase from 4.36 cents/kWh in 1978 and a 211% increase from 2.41 cents/kWh in 1973.

The average price privately owned electric utilities charged industrial

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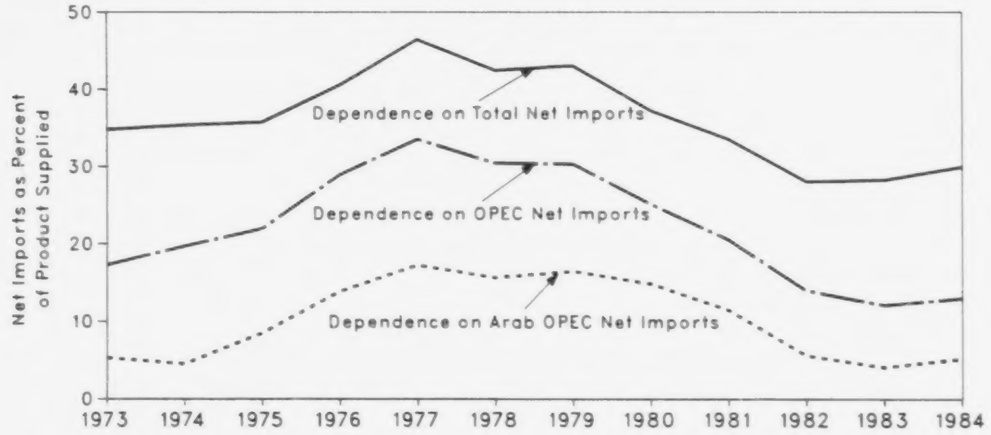

U.S. Dependence on Petroleum Net Imports

FUEL AND ENERGY

FROM PRECEDING PAGE

customers in November, 1985, was 5.1 cents/kWh, up 0.8% from 5.06 cents/kWh in November, 1984. The 1985 price represented a 40.9% increase over the 3.62 cents/kWh charged industrial customers in 1978 and a 308% increase over the 1.25 cents/kWh charged in 1973.

In more specific terms, the residential rate for 500 kW of electricity in November, 1985, expressed in cents/kWh, ranged from 2.07 in Seattle, Wash., 6.7 in Indianapolis, Ind., and 6.73 in Louisville, Ky., to 9.15 in Cleveland, Ohio, 9.7 in Boston, and 9.84 in Miami, Fla. Detroit registered a 24.3% increase in the past year to 9.06 cents/kWh while Chicago (−17.2%), Boston (−10.2%), Columbus, Ohio (−6.1%), Los Angeles (−6%), Milwaukee, Wis., and Dallas and Fort Worth, Texas, all registered decreases.

For commercial customers, the rate for 10,000 kWh of electricity together with 40 kW of demand in November, 1985, also expressed in cents/kWh, ranged from 7.02 in Milwaukee, Dallas, and Fort Worth to 9.29 in Chicago, 9.61 in Cleveland, and 10.26 in Boston. The top increase was 5.9%, and decreases in seven cities ranged up to 9.7% (Boston).

For industrial customers, the rate for 200,000 kWh of electricity together with 500 kW of demand, also expressed in cents/kWh, ranged from 4.05 in Indianapolis, 4.70 in Louisville and 4.80 in Milwaukee to 7.10 in Buffalo, N.Y., 7.55 in Miami, and 7.61 in Boston. Decreases of 12.2% in Boston, 8.7% in Columbus, Ohio, and 5.2% in Milwaukee were balanced by increases of 8.4% in Denver, Colo., and lesser amounts in most other cities.

Electricity

Total industry electricity output for the 52 weeks ended Dec. 28, 1985, was 2,501,844 million kWh, an increase of 2.6% from the 2,438,724 million kWh output for the same period a year earlier, according to the Edison Electric Institute (EEI).

The increases of the past two years — following only the third decline in modern history — reflects the growing economy. Increases were registered in all regions. The Rocky Mountain states (4.1%), New England, and the Southeast (each at 3.6%) led the pack. The smallest increase, at 1%, was in the Midwest farm belt.

EEI reported that total electric power generation for the last quarter of 1984 and the first three quarters of 1985 amounted to 2,443,475 million kWh, an increase of 1.25% from the 2,413,190 million kWh for the same period a year earlier.

EIA reported that, of the total for the first 11 months of last year, 56.6% was generated by coal; 4% by oil; 12% by natural gas; 15.6% by nuclear reactors; 11.4% by hydro; and 0.4% by other means. This represented a 19% reduction in generation from oil and a 15% increase in the nuclear component when contrasted with year-earlier experience.

Electricity sales to ultimate customers for the last quarter of 1984 and the first three quarters of 1985, according to EEI, totaled 2,203,843 million kWh, up 1.46% from the 2,270,787 million kWh sold during the same period a year earlier.

Of that total, residential sales totaled 787,631 million kWh, up 1.6% from 777,399 million kWh; commercial sales totaled 604,161 million kWh, up 5% from 575,549 million kWh; and industrial sales totaled 823,080 million kWh, down 1.2% from 833,428 million kWh.

The installed nameplate generating capacity of U.S. electric generating plants at the end of the third quarter of 1985 was 687,208 megawatts (MW), up 3.6% from the 663,470 MW capacity at the same time a year earlier. Of this, 67.9% was conventional steam; 11.7% was nuclear; 11.9% was hydro; 7.5% was gas turbine; 0.7% was internal combustion; 0.2% was geothermal; 7 MW was wind turbine; and 1 MW was solar.

Of the 49 generating units put in service in the first 11 months of 1985, a total of 28 units were hydroelectric, 11 were coal-fired, eight were nuclear, one was wind-powered (North Dakota), and one was geothermal (Bottle Rock, Calif.).

EEI reported that, at the end of the third quarter of 1985, the average number of electric utility customers totaled 100,549,000, a 2.4% increase over the average of 98,237,000 at the same time a year earlier.

Nuclear

During November, 1985, U.S. nuclear power plants generated a total of 30.1 billion net kWh of electricity, an increase of 22.5% over the 24.575 billion net kWh generated in the same month of 1984. The total for the first 11 months of 1985, at 349,903 million net kWh, represented a 17.9% increase over the 296,762 million net kWh for the same period a year earlier.

Nuclear power routinely supplied more than 15% of the power generated by domestic utilities in 1985, up from an average of 13.6% in 1984. In September, 1985, nuclear supplied 17% of the nation's electricity.

As of November, 1985, there were 95 operable U.S. nuclear power generating units with a collective net generating capacity of 79.2 million kW. Of the 95 operable units, five were in power ascension, and 29 units generated no power or operated substantially below capacity. Two units had been licensed for fuel loading and low-power testing.

As of Nov. 30, 1985, there were 130 domestic nuclear power generating units in all stages of planning, construction, or operation, with an aggregate design capacity of 121 million net kW. It is also significant that no new nuclear power plants have been announced since 1978 and that, since then, plans for dozens of plants have been cancelled.

Natural gas

Gas utility thermal equivalent sales were estimated at 12,588.8 trillion Btu in 1985, a decline of 4.4% from the 13,161.7 trillion Btu equivalent in 1984, according to the American Gas Association (AGA).

Industrial sales, which represent 29.5% of the total, were 3,712.1 trillion Btu, down 12.5% from 4,241 trillion Btu in 1984. Sales for electricity generation (14.5% of the total) were 1,823 trillion Btu in 1985, up 4.2% over 1,750 trillion Btu in 1984. Residential sales (36.1% of the total) were 4,548.1 trillion Btu, down 1.7% from 4,628.3 trillion Btu in 1984. Commercial sales (18.8% of the total) were 2,363.8 trillion Btu, down 1.3% from 2,396 trillion Btu in 1984. Other sales (1.1% of the total) were 141.8 trillion Btu, about the same as in the previous year.

AGA reported that average natural gas utility prices, expressed in dollars/million Btu, in December, 1985, were: all $5.019; residential $5.912; commercial $5.418; industrial $4.258; electricity generation $3.855; and other $4.644.

Oversupply

Although the effect of the precipitous drop in world oil prices is discussed in more detail in "1986 in perspective," it is significant to note that gas prices were coming down even before that recent development. Instead of going up when the price of some 60% of interstate gas was decontrolled on Jan. 1, 1985, prices came down.

The primary reason for the decline in gas prices in 1985 was the fact that about 2.8 trillion cu ft of available domestic gas production was not sold for lack of a market. This surplus, or "bubble," is expected to decline to about 2.5 trillion cu ft in 1986, or about 15% of available production, and is not expected to disappear until well into the 1990's.

The result of the oversupply problem has been that many new gas wells with higher production costs have either been capped or their production put on the "spot" market where prices at the end of 1985 were about $2/1,000 cu ft versus $3/1,000 cu ft a year earlier.

AGA reported that, according to pipeline filings before the Federal Energy Regulatory Commission, pipelines at year-end were paying an average of 7.5% less for U. S. and Canadian natural gas. Residential prices were expected to fall 8% in the October-March (1986) heating season from the same period a year earlier.

There appears to be no problem with natural gas reserves in the forseeable future. DOE reported that additions to the lower-48 state proved reserves in 1984 were 82% of domestic production. (From 1981 through 1984, reserve additions averaged 96% of production).

Imports from Canada in 1985 were estimated at 950 billion cu ft (5% of U.S. consumption), up from 760 billion cu ft in 1984. Canadian exports to the U.S. in 1986 could reach 1,050 billion cu ft and are expected to increase each year because of a more market-responsive export pricing policy. The importing of Mexican and Algerian natural gas has been curtailed because of price considerations.

Exploration

Total exploration and development well completions in 1985 amounted to 77,120, a decrease of 8.1% from the 83,890 exploratory wells drilled in the previous year. The 1985 total represented a 14.4% drop from the record 90,300 exploratory wells drilled in 1981.

Oil well completions totaled 37,920 in 1985, down 10.4% from the 42,330 oil wells drilled in the previous year. The 17,460 gas wells completed last year represented a 3.9% increase over the 16,810 gas wells completed in 1984. Total footage drilled in 1985 was 336.9 million ft, a drop of 7.8% from the 365.6 million ft drilled in the previous year.

The January, 1986, rotary rig count of 1,810 was 26.2% less than the 2,452-rig count in January, 1985. The 175 rigs operating offshore were 27.7% fewer, and the 1,635 rigs operating onshore were 26% fewer than those operating in January, 1985. The average of 378 crews operating in seismic exploration in 1985 represented a 30.7% decline from the average of 494 crews in 1984.

Rotary rig activity during 1985 averaged 1,980 rigs, a decline of 18.5% below 1984 activity, and 50.1% less than the record high of 3,970 rigs in 1981.

Coal

The U.S. coal industry anticipates a flat year in 1986. Production is expected to reach 888 million tons, only 0.3% above the 1985 total of 885 million tons, according to the National Coal Association (NCA). Production last year was 1.3% below the 897 million tons produced in 1984.

The flat spot on the growth curve was explained by NCA's Economics Committee as the result of short-term market adjustments.

Drought in areas where hydroelectric power is a major market factor led to higher-than-normal demands on coal-fired power generation. But the effect on coal producers was dampened because electric utilities drew significant amounts of coal from bloated stockpiles built in 1984 in anticipation of a miners' strike that never happened.

In 1986, the number of nuclear power plants coming on-line will more than offset the increase of new coal-fired units. The net effect will be a reduction in coal's share of the 1986 power generation market.

Domestic consumption, which increased 3.2% from 791 million tons in 1984 to 816 million tons last year, will decline in 1986 by 0.6% to 811 million tons, according to NCA. Exports, which

TURN TO NEXT PAGE

Our unofficial estimates of unitary market shares

When it comes to figuring the shares of the unitary air conditioning market held by individual manufacturers, we must rely on "feel" rather than reliable numbers. There are no reliable numbers.

Each year, too, the percentages shift as companies enter or leave the market, one company is acquired by another, or distribution-product-promotion improvements are reflected in the marketplace.

And, like all national figures they do not give a clear picture of what is happening in any specific city or area of the country. In fact, some of the essentially regional manufacturers, with a small national share of market, often are among the leaders in those areas where their distribution is concentrated.

Another distortion comes from the interest of the reader. Whether a particular manufacturer is strong in the new construction, add-on, or replacement market makes little difference to many. But to a contractor who specializes, the list of competitive brands can expand or contract according to his interests — and change when his emphasis changes.

Because of these and other situations within their own cities, contractors often get a distorted view of national market shares. For them, and for market researchers not deeply involved with the air conditioning industry, The News offers these educated guesses of unitary equipment market share in units:

Carrier (including Bryant, Day & Night, and Payne) — 25%.

Rheem-Ruud — 14%.

Trane — 13%.

Lennox — 10%.

Whirlpool, Heil-Quaker — 7%.

Borg-Warner Central Environmental Systems (including York) — 7%.

SnyderGeneral (including Arcoaire and Comfortmaker) — 6%.

Magic Chef (including Johnson, Air Ease, Williams, Armstrong, Gaffers & Sattler) — 3%.

Heat Controller — 2%.

FUELS

FROM PRECEDING PAGE

increased by 7.4% from 81 million tons in 1984 to 87 million tons last year, will drop by 9.2% in 1986 to 79 million tons.

In 1985, mines east of the Mississippi produced 574 million tons, or 64.9% of the total. Western mines produced 311 million tons, or 35.1% of the total. In 1986, western mine production is expected to increase by 1.6% to 316 million tons while eastern mine production drops marginally to 572 million tons.

Electric utilities, which consume more than three-quarters of U.S. domestic production, are expected to require the same amount of coal in 1986 as in 1985 (689 million tons). The 1985 total represented a 3.8% increase over the 664 million tons consumed by utilities in the previous year.

No improvement is forseen for the steel industry. Metallurgical (coking) coal production, which declined 6.8% from 44 million tons in 1984 to 41 million tons last year, is expected to hold even in 1986 because of greater electric furnace use and the continuing market penetration of continuous casting methods.

Coal demand in the industrial-retail sector, which increased by 3.6% from 83 million tons in 1984 to 86 million tons last year, is expected to decline in 1986 by 4.7% to 82 million tons. This projection allows for a 2.3% increase in industrial coal consumption.

Total coal exports, at 87 million tons last year, were up 7.4% over the 81 million tons exported in 1984 despite a 20% drop (from 20 million tons in 1984 to 16 million tons last year) in Canadian exports. Rebuilding of inventories following the British miners' strike and concern by coal-importing countries about South African purchases were credited with much of the increase.

The outlook for exports in 1986, however, is for a decline of 9.2% to 79 million tons. An additional decline of 2 million tons in shipments to Canada, and less-than-normal purchases by Japan, are listed as the prime contributors.

NCA reported that, of the coal tonnage moved to utilities in 1984, rail shipments accounted for 59%. Another 17% was moved by water and 12% was moved by truck. Inland waterways were used to distribute 116 million tons of coal in 1984, a 25% increase over the previous year's performance.

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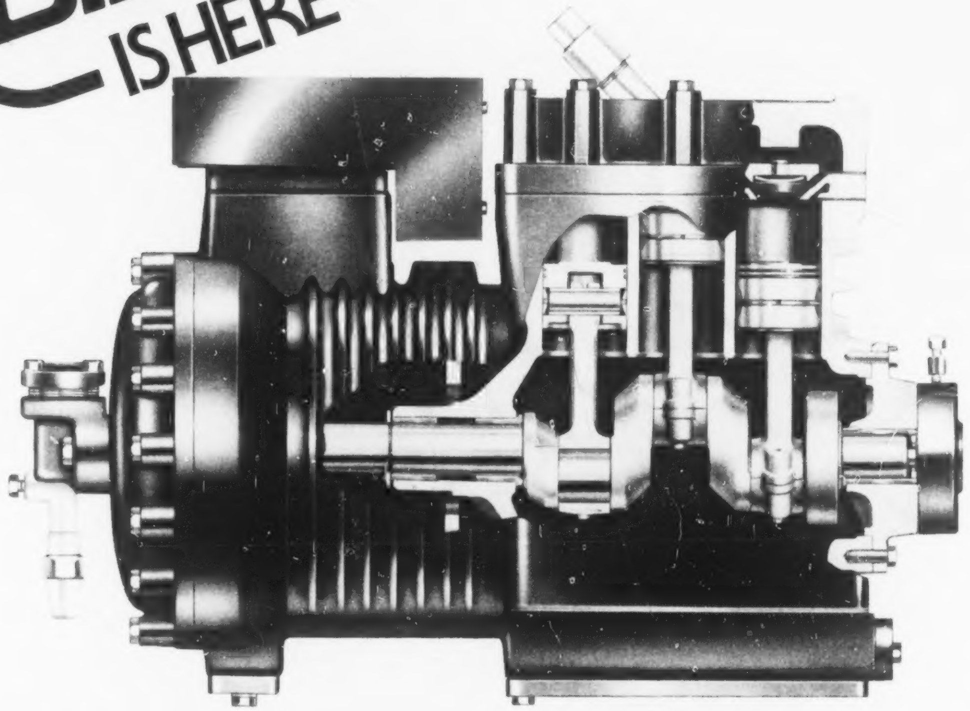

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